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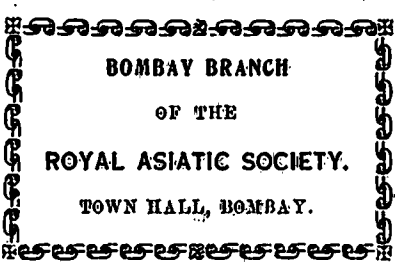

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Annual Report of the All-India Institute of Hygiene and Public Health Calcutta 1934

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CALCUTTA
GOVERNMENT OF INDIA PRESS
1935

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TOWN HALL, BOMBAY.

VIEW OF THE INSTITUTE.

Annual Report of the All-India Institute of Hygiene and Public Health Calcutta 1934

CALCUTTA
GOVERNMENT OF INDIA PRESS
1935

STAFF AND STUDENTS, 1934-35.

Sitting from left to right:—Mr. N. L. Banerji, Dr. A. C. Ukil, Dr. H. Ellis C. Wilson, Dr. R. B. Lal, Lt.-Col. A. D. Stewart, Lt.-Col. A. A. E. Baptist, Dr. K. V. Krishnan, Dr. K. C. K. E. Raja, Dr. B. Ghosh.

Front-row-standing left to right:—Mr. D. C. De, Mr. B. N. Mitra, Dr. S. C. Ghoshal, Dr. S. Ahmed, Dr. G. A. Charnalia, Dr. K. G. Mundagnur, Dr. D. N. Chaudhuri, Dr. C. A. Fegredo, Dr. U. Lat, Dr. R. S. Bhatnagar, Dr. Nasiruddin Miah, Dr. N. C. H. Rustomjee, Dr. J. Sen, Dr. E. D. Widge, Dr. Md. Zarif Khan, Dr. P. K. Banerji.

Back-row-standing left to right:—Dr. N. Mukherji, Dr. A. Thomas, Dr. R. Banerji, Dr. B. Bhowmik, Dr. C. Gopalan Nair, Dr. P. Menon, Dr. Md. Abul Khair, Dr. P. B. Basu.

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All-India Institute of Hygiene and Public Health, Calcutta.

Director.

Lt.-Col. A. D. Stewart, C.I.E., M.B., F.R.C.S.E., D.P.H., D.T.M. & H., I.M.S.

Assistant Director.

Lt.-Col. A. A. E. Baptist, M.B.E., I.M.D. (R).

A.—Staff of the Institute of Hygiene.

Department of Public Health Administration—

Professor—Lt.-Col. A. D. Stewart, C.I.E., M.B., F.R.C.S.E., D.P.H., D.T.M. & H., I.M.S.

Assistant Professor—Vacant.

Department of Bio-Chemistry and Nutrition—

Professor—Dr. H. Ellis C. Wilson, M.B., CH.B., D.SC.

Assistant Professor—Dr. Bashir Ahmad, M.SC., PH.D.

Department of Epidemiology and Vital Statistics—

Professor—Dr. R. B. Lal, M.B., B.S., D.P.H., D.T.M. & H., D.B.

Assistant Professor—Dr. K. C. K. E. Raja, L.M.S., L.R.C.P. & S., D.P.H., D.T.M. & H.

Department of Malariology and Rural Hygiene—

Professor—Dr. K. V. Krishnan, M.B., B.S., D.B., M.R.C.P., D.SC.

Assistant Professor—Dr. Banamali Ghosh, M.B., D.P.H.

Department of Maternity and Child Welfare—

Professor—Dr. Jean M. Orkney, M.B., CH.B., D.P.H., W.M.S.

Assistant Professor—Vacant.

B.—Staff of the Calcutta School of Tropical Medicine.

Department of Protozoology—

Professor—Lt.-Col. R. Knowles, B.A. (CANTAB.), M.R.C.S., L.R.C.P., I.M.S.

Assistant Professor—Dr. Biraj Mohan Das Gupta, L.M.P. (DACCA).

Department of Pharmacology—

Professor—Lt.-Col. R. N. Chopra, C.I.E., M.A., M.D. (CANTAB.), I.M.S.

Assistant Professor—Dr. J. C. Gupta, M.B. (CAL.).

Department of Public Health Laboratory Practice—

Professors—

Dr. B. B. Brahmachari, L.M.S., D.P.H. up to 31st October 1934.

Dr. A. K. Sen, B.SC., M.B. (CAL.), D.P.H. (ENG.), M.R.C.P. (EDIN.), from 1st November 1934.

Assistant Professors—

Dr. Susanta Chandra Ghosal, M.B. (CAL.), D.P.H. (CAL.), D.B. (LONDON).

Mr. Nani Lal Banerjee, M.SC. (CAL.), A.I.C.

Chemist—Mr. D. C. De, B.SC.

Department of Pathology, Bacteriology and Helminthology—

Professor—Captain C. L. Pasricha, M.A., M.B., B.CHIR. (CANTAB.), M.R.C.S. (ENG.), L.R.C.P. (LONDON), I.M.S.

Assistant Professors—

Dr. Ganapati Panja, M.B. (CAL.), D.B. (LOND.).

Dr. Kalipada Banerjee, M.B. (CAL.), D.T.M. (CAL.).

Department of Entomology—

Professor—Dr. C. Strickland, M.A., M.D. (CANTAB.), B.CHIR., F.R.G.S.

Assistant Professor—Dr. D. N. Roy, M.D. (CAL.), D.T.M. (CAL.).

Department of Serology and Immunology—

Professor—Major S. D. S. Greval, B.SC., M.D., ch.B., D.P.H, I.M.S.

Assistant Professor—Captain S. N. Chandra, M.B. (CAL.).

Department of Chemistry—

Professor—Dr. S. Ghosh, M.SC. (CAL.), D.SC., F.R.S. (EDIN.), F.C.S. (LOND.).

Assistant Professor—Mr. Nihar Ranjan Chatterjee, M.SC. (CAL.).

C.—Special Research Staff (under the Indian Research Fund Association).

1. Cholera Carrier and Epidemiological Enquiries—

Officers-in-charge—

(1) Captain C. L. Pasricha, M.A., M.B., B.CHIR. (CANTAB.), M.R.C.S. (ENG.), L.R.C.P. (LOND.), I.M.S.

(2) Dr. R. B. Lal, M.B., B.S., D.P.H., D.T.M. & H., D.B.

(3) Dr. R. W. Linton, PH.D.

(a) *At Head Quarters*—

Research Assistant—Mr. Satya Swaroop, M.A.

Bacteriologists—

Dr. Srish Chandra Seal, M.B.

Dr. Promode Chandra Das, L.M.F.

(b) *Field Section*—

Epidemiologist—Dr. Jayanta Kumar Bhattacharjee, M.B., D.P.H.

Assistant Bacteriologist—Dr. Monoranjan Kar, M.B.

2. Cholera Clinical Enquiry—

Officers-in-charge—

(1) Lt.-Col. N. C. Kapur, M.R.C.S. (ENG.), L.R.C.P. (LOND.), I.M.S.

(2) Captain C. L. Pasricha, M.A., M.B., B.CHIR. (CANTAB.), M.R.C.S. (ENG.), L.R.C.P. (LOND.), I.M.S.

Bacteriologist—Dr. E. O'G. Flynn, D.T.M., I.M.D.

3. Enquiry into the Chemical Structure of the Cholera and Cholera like Vibrio—

Officer-in-charge—Dr. R. W. Linton, PH.D.

1st Assistant—Dr. D. L. Shrivastava, D.SC.

2nd Assistant—Mr. B. N. Mitra, M.SC.

4. Tuberculosis Enquiry—

Officer-in-charge—Dr. A. C. Ukil, M.B.

1st Assistant—Dr. S. R. Guha Thakurta, M.B.

2nd Assistant—Dr. N. G. Mazumdar, M.B.

ANNUAL REPORT OF THE ALL-INDIA INSTITUTE OF HYGIENE AND PUBLIC HEALTH FOR THE YEAR 1934.

As this is the first Annual Report of the Institute, it will not be out of place to recapitulate shortly the ideas and events which led to the conception of an All-India Institute of Hygiene, to its construction, and finally to its formal opening on December 30th, 1932.

Public health policy in India started with the taking over of the administration of British India by the Crown in 1857. The high mortalities among British and Indian troops and in the civil population attracted the attention of Parliament and in 1860 a Royal Commission visited India and made recommendations for the improvement of health and sanitary conditions in India. This Commission recommended that Sanitary Commissions should be appointed in the major provinces of Madras, Bengal, and Bombay. These commissions were established and for some years did good work. Departmental jealousies and other causes however led to their gradual emasculation and by 1900 they had been reduced to one officer, the Sanitary Commissioner, who had little or no staff and whose duties were largely confined to inspecting vaccinations. The advent of plague in 1896 led to a general awakening of everyone's responsibilities in the matter of health and prevention of disease, and in 1912 the Government of India formulated an important declaration of sanitary policy, establishing research on a sound basis, and giving grants to Local Governments for the augmentation of their sanitary staff, both central and provincial. The Government of India in a resolution insisted that candidates for Assistant Directorships of Public Health should have a British Diploma of Public Health. Health Officers of first class towns were required to have a registrable qualification and a British Diploma of Public Health. In this resolution they stated, " The necessity for a British Diploma of Public Health will however only be temporary, as the Government of India trust that it may be possible to waive the second restriction as soon as arrangements can be made in India which will enable Indians trained in this country to become Health Officers of the first class ".

Provincial governments took up the question of providing such training, and qualifications in public health and higher diplomas and degrees demanding specific courses of training were initiated by the universities of Bombay, Madras, Calcutta and Lucknow. These, however, naturally retained a provincial outlook. The conception of providing courses in hygiene on a wider basis originated with Sir Leonard Rogers who in 1914 conceived the idea of establishing institutes in India for post-graduate study in tropical medicine and hygiene. Sir Leonard's first proposal was that there should be a School of Tropical Medicine in Calcutta, and an Institute of Hygiene in Bombay, and that both of these might be on an All-India basis. Various circumstances and considerations prevented these views from coming to fruition, but it was chiefly owing to Sir Leonard Rogers' perseverance and enthusiasm and to the generosity of the Governments of India and Bengal and various private

benefactions, that in 1920 the Calcutta School of Tropical Medicine and Hygiene which combined teaching and research in both tropical medicine and hygiene was opened. A Professorship in Hygiene was established, and a course of instruction arranged in the School for the Diploma of Public Health of the Calcutta University. There were obvious limitations to the scope and outlook of this arrangement. However enthusiastic one man may be, there are now so many aspects of public health both of temperate and tropical climates, each of which is rapidly developing and requires the full attention of a single worker and teacher, that it is impossible for a single person to combine the qualities or to find the time necessary to assimilate, digest and teach the diverse subjects comprising the entity known as modern public health. Workers highly trained in general hygiene and specialists in some particular branch are needed in India, and as time goes on and public health policy broadens and expands in all Indian provinces, such workers trained in Indian needs and with Indian experience will be more and more required. Major-General Sir J. D. Graham, C.I.E., I.M.S., the then Public Health Commissioner with the Government of India, said in his Annual Report for 1925 (Section VIII):—

"*The need of providing training for public health workers.*—Certain conclusions have been forced upon me after careful study of the position over the last few years. It is becoming increasingly evident that a considerable section of the Indian community is thinking seriously on these public health problems."

"This is a work which has to be done for the benefit of Indians. To be effective it must carry conviction and establish its position against immemorial conservatism and tradition, it must therefore be done by Indians. It presents a grand and unlimited field for public health workers, but it is well to recognize that the improvement cannot be achieved when the expert labourers are too few in number, that these cannot be increased to the requisite number without a careful system of specialised training in institutes or schools devoted to public health teaching and research, and that cannot be done without adequate financial support. The need for such training of Indian personnel has been advocated for the last two decades by our expert hygienists and research workers in India. It has often been represented, and not without justice, that scientific knowledge in regard to the prevention of certain communicable diseases has far outstripped its application in the field. It is with such a personnel that the practical application must finally rest." As head of the Calcutta School of Tropical Medicine and Hygiene, Major-General Sir John Megaw arrived at similar views, which were expressed from time to time in the Annual Reports of the School. Dr. W. S. Carter, M.D., Associate Director of the Rockefeller Foundation, in his periodic tours of India and the Far East, met General Megaw and General Graham on various occasions and became deeply impressed with the necessity for establishing an All-India Institute of Hygiene. Much of the teaching in basic subjects, such as bacteriology and protozoology, for the Diploma of Public Health is similar to that for the Diploma of Tropical Medicine, and as this was being taught in the School of Tropical Medicine, Dr. Carter at once grasped the obvious advantages of Calcutta as a location for an All-India Institute, and of a site close to the Calcutta School of Tropical Medicine, where the

basic subjects would continue to be taught. It would thus be unnecessary to duplicate these courses, and at the same time the Institute would deal with purely public health subjects especially related to Indian requirements. As a result of discussion with General Megaw and others, Dr. Carter, on behalf of the Rockefeller Foundation, addressed the Government of India in terms embodying these proposals, offering to provide the cost of acquiring the site selected, and to build and equip an All-India Institute of Hygiene and Public Health, and further asking for the Government of India's assurance that they would meet the recurring cost of staff and maintenance after the building was handed over to them. The Government of India gratefully accepted this munificent offer and negotiations for the acquisition of the site were commenced. This was acquired finally in July 1930, and the site was cleared and building commenced in September. A Constructional Committee composed of the Public Health Commissioner with the Government of India, the Surgeon-General with the Government of Bengal, the Chief Engineer with the Government of Bengal, the Chairman of the Calcutta Improvement Trust, and the Accountant-General, Bengal, was appointed to arrange for the construction of the building. Lt.-Col. A. D. Stewart, C.I.E., I.M.S., Professor of Hygiene in the Calcutta School of Tropical Medicine, was appointed Director-Designate of the new Institute, and Lt.-Col. A. A. E. Baptist, M.B.E., I.M.D. (RETD.), Assistant Director, to superintend the actual details of construction and equipment.

The building was completed early in 1932 and was formally opened by H. E. Sir John Anderson, Governor of Bengal, H. E. the Viceroy being unable to perform the function owing to indisposition.

The building practically adjoins the School of Tropical Medicine with which it harmonises in design and appearance.

The plan is based on the " unit room " system, the unit room being 25 by 21 feet. The building is four storeyed and is E-shaped, the long limb being in the centre. Six sections can be accommodated, *viz.*, (1) Public Health Administration, (2) Sanitary Engineering, (3) Vital Statistics and Epidemiology, (4) Biochemistry and Nutrition, (5) Malariology and Rural Hygiene, and (6) Maternity and Child Welfare and School Hygiene. Each section has one unit room for the head of the section and two unit rooms for the workers. The working sections are placed in the central limb of the building, facing north with an excellent and unimpeded north light. In the west block are placed the administrative rooms, lecture theatre, practical class rooms, museum, and a large auditorium to seat 200 people. The eastern limb houses store rooms, common room, and lunch room for students, spare working rooms and lavatories, while a separate annexe provides for an animal room on each floor. The library is in the centre block on the top floor. Three unit rooms on each floor and the library and reading room are provided with conditioned air during the hot months of the year. The head of each section has a cooled unit room and in addition there is a spare cooled unit room on each floor where workers on that floor may work in comfort, or engage in any special work requiring a cooled atmosphere.

Administrative and Scientific Control.—It was the wish of the Rockefeller Foundation in making the gift to the Government of

India, that the general scientific control of this Institute should be vested in the Governing Body of the Indian Research Fund Association. This has been accepted in principle, but the Governing Body of the Indian Research Fund Association have devolved the scientific control of the Institute in a committee with the following composition:—

1. The Member of the Governor-General's Executive Council in charge of the Department of Education, Health, and Lands or the Secretary to the Government of India in the Department of Education, Health and Lands, if deputed by the Member by general or special order to act as Chairman on his behalf	President.
2. The Director-General, Indian Medical Service.	Members.
3. The Public Health Commissioner with the Government of India.	
4. The Director, School of Tropical Medicine, Calcutta.	
5. The Director, All-India Institute of Hygiene and Public Health, Calcutta.	
6. One medical or scientific non-official member of the Governing Body of the Indian Research Fund Association to be elected by that body.	
7. One medical non-official member of the Governing Body of the Indian Research Fund Association to be elected by that body.	
8. One of the representatives of the Legislature (whether of the Legislative Assembly or of the Council of State) on the Governing Body of the Indian Research Fund Association to be elected by that body.	

The Public Health Commissioner with the Government of India, and during his absence the Deputy Director General, Indian Medical Service, will act as Secretary.

This Committee also acts as a Recruitment and Appointments Board for the Institute, the superior staff being selected by it. The general administrative control is vested in the Director General, Indian Medical Service, subject to the ultimate control of the Government of India in the Department of Education, Health and Lands.

Sections.—The Rockefeller Foundation proposed and the Government of India agreed to open six sections in the Institute, *viz.*:—

(1) Public Health Administration.

(2) Malariology and Rural Hygiene.

(3) Epidemiology and Vital Statistics.

(4) Nutrition and Bio-Chemistry.

(5) Sanitary Engineering.

(6) Maternity and Child Welfare.

Owing to the sudden financial crisis at the end of 1931, however, the Government of India found themselves unable to shoulder the financial burden of Rs. 3,50,000 per annum which the six sections required and decided to allot a sum of Rs. 2,00,000 per annum, agreeing to restore the original sum when monetary conditions improved. Accordingly only 4 sections were opened, the sections of Sanitary Engineering and Maternity and Child Welfare remaining in abeyance. The Committees of the Countess of Dufferin Fund however and of the Red Cross Association of India realising the importance of the section of Maternity and

Child Welfare and especially the necessity for providing post-graduate instruction in the work not only for men but especially for women graduates, agreed to lend the services of Dr. Jean M. Orkney to initiate the section and also to grant the necessary funds to finance the section.

In 1933 advertisements for the superior staff were issued and eventually the Board of Scientific Control, helped by a Consultative Committee in England, selected the following staff who joined on the dates mentioned:—

1. Lt.-Col. A. D. Stewart, C.I.E., M.B., F.R.C.S.E., D.P.H., D.T.M., I.M.S., Director and Professor of Hygiene and Public Health Administration.	Appointed Director-designate on 1st October, 1929.
2. Lt.-Col. A. A. E. Baptist, M.B.E., I.M.D. (RETD.), Assistant Director.	Appointed on 1st June, 1929.
3. Dr. R. B. Lal, M.B., B.S., D.P.H., D.T.M. & H., D.B., Professor of Vital Statistics and Epidemiology.	Joined on the 20th January, 1934.
4. Dr. K. C. K. E. Raja, L.M.S., L.R.C.P. & S., D.P.H., D.T.M. & H., Assistant Professor of Vital Statistics and Epidemiology.	Joined on the 7th February, 1934.
5. Dr. H. Ellis C. Wilson, M.B., ch.B., D.SC., Professor of Bio-Chemistry and Nutrition.	Joined on the 24th March, 1934.
6. Dr. Bashir Ahmad, M.SC., PH.D., Assistant Professor of Bio-Chemistry and Nutrition.	Joined on the 2nd January, 1934.
7. Dr. K. V. Krishnan, D.SC., M.B., B.S., D.B., M.R.C.P., Professor of Malariology and Rural Hygiene.	Joined on the 9th February, 1934.
8. Dr. Bonomali Ghosh, M.B., D.P.H., Assistant Professor of Malariology and Rural Hygiene.	Joined on the 5th June, 1934.

The Assistant Professor of Public Health Administration has not yet been appointed, but it is hoped this appointment will shortly be made.

In consequence of the section of Sanitary Engineering being kept in abeyance for the present, a certain amount of laboratory accommodation was available in the Institute and it has been found possible to house certain researches and investigations of an important nature. Dr. Muir who is in charge of Leprosy Research work under the British Empire Leprosy Research Association, the Indian Research Fund Association, and the Governing Body of the School of Tropical Medicine required extra rooms, and he has been given a large room for research work in leprosy. Dr. Ukil's Tuberculosis Enquiry and the Kala-azar Enquiry which is attached to the School of Tropical Medicine has also been accommodated. Dr. Linton working on the basic structure of the cholera vibrio is housed in the Institute, and the Anopheles Indlowi Enquiry of the Bengal Public Health Department has been allotted rooms.

Functions and purpose of the Institute.—It has often been stated and with a considerable degree of truth, that scientific research work and knowledge of disease in India has far outstripped its practical

application throughout the country. How to achieve this in practice is one of the most difficult and fundamental difficulties in India. To apply scientific knowledge to prevention of disease requires at the beginning a desire for health on the part of the whole population, both as individuals and as a community. Knowledge acquired by such a desire must be put into daily and constant practice by everyone, and everyone must be prepared to pay something towards concerted action. Local bodies must be actuated by the same desire to improve the environmental conditions of the villages, towns, and districts under their charge, and must be furnished with the necessary powers and necessary funds. They must however have the guidance of an expert sanitary officer who has under his control a sufficient and trained staff. Local bodies in their turn must be guided and controlled and when necessary compelled by a competent department of health of the local government, whose duties and powers will have been laid down clearly by the legislature. All this requires wise and farsighted statesmanship and legislation, and calls for the exercise of the highest and best features of individual and national character. It demands a certain status of economic development of the people, and a certain standard of education throughout, and above all an understanding of the value and the possibilities of human existence and a constant desire for improvement and betterment. It is quite obvious that the establishment of one Institute cannot do all this but it can play an important part. While it may later have wider spheres, at first it must take on the important rôle of training staff who will later play the important part of improving environmental conditions throughout India, and of advising local bodies, and educating the people in the principles and practice of health ideals. This training will always be one of the main tasks of the Institute and every endeavour will be made to make this training as good as possible, keeping in view the needs and problems of the different provinces of India. In this training the School of Tropical Medicine co-operates to the fullest extent and the subjects of Bacteriology, Protozoology, Entomology, and Public Health Laboratory Practice are taught by the staff of the School. Though the School of Tropical Medicine is a provincial institution under the Government of Bengal, it has never really been provincial in training or outlook, and it is in the interest of the whole of India that the teaching in the School should remain at a high standard of excellence.

Post-graduate qualifications such as the Diploma of Public Health or B. Sc. in Sanitary Science are required for most health appointments. The University of Calcutta has for some years given a Diploma of Public Health which in common with such qualifications granted by other Indian universities is accepted for many of the health appointments in India. The School of Tropical Medicine is already affiliated to the University of Calcutta and the Institute will shortly also be affiliated. Most of the post-graduates under training proceed to take the Diploma of Public Health of the Calcutta University. This is open only to graduates, however, and it is recognised that there are many workers in public health in India, both in military and civil employ, and in Indian States, who would benefit greatly by a thorough training in public health, and who could proceed to a career in public health and in sanitary departments if they also possessed a diploma in public health. This question was very carefully considered by the Government

of India and the Government of Bengal, and it was agreed that a Diploma in Public Health and Hygiene should be granted by the Faculty of Tropical Medicine and Hygiene of Bengal. This Diploma will be essentially of the same standard as the D. P. H. of the Calcutta University. Candidates for training for this Diploma will be specially selected. They may be Sub-Assistant Surgeons who have done health work or they may be holders of medical diplomas who have shown special aptitude in health work or research, or military assistant surgeons not holding a university degree. Applications for this course are carefully considered by the Selection Committee and only such applicants accepted as are considered suitable by education and achievement, to benefit by the course.

The regulations for the D. P. H. of Indian universities are mostly based on those of the General Medical Council of Great Britain. The training for the D. P. H. in Great Britain is specially designed for training and turning out doctors fitted to be Assistant Medical Officers of Health in the United Kingdom. Public health conditions and public health administration are peculiar to each country and it is obvious that more and more of our health officers should be trained in India, though the broadening and educative value of study and travel abroad will always be desirable. The work of an Assistant Medical Officer of Health in Great Britain is largely confined to urban areas, as over 80 per cent. of the population in the United Kingdom live in fairly large towns. It is natural that his training in practical public health administration should be done in towns, and the regulations of the General Medical Council insist on this. In India it is different as most of the population live in rural areas. The regulations for the D. P. H. in India however being based on those of the General Medical Council still insist on training in methods of public health administration in a large town. While this is undoubtedly both necessary and desirable the necessity for practical training in rural health problems has been overlooked or not sufficiently stressed. One reason for this has been the lack of well organised rural health organisations where up-to-date methods dealing with the problems of a rural area in India could be demonstrated. I think the University regulations in this respect need reconsideration, but until we have better organisations in rural areas it may be better to leave this question as it is at present and to demonstrate the present problems of rural areas as they now exist. A Malaria Research Station in a rural area is a necessity for a teaching institution and while we have established the nucleus of such a station near Calcutta, it needs enlarging and putting on a better basis. I have already addressed the Government of India on this question. The Rockefeller Foundation are very interested in the matter of the betterment of rural health conditions in the East and they have been instrumental in establishing what are called 'Rural Health Units' in Ceylon, Burma, and some provinces of India. Their method is to take an area of about 30,000 people comprising a group or groups of villages and establish a staff of sanitary officers in it to survey the conditions and then tackle the problems. I am in communication with the Government of Bengal regarding the establishment of such a rural health unit in Bengal. Such a unit serves as a model and example to the area itself and to others, and as a training ground for health officers, sanitary inspectors, and health

visitors. I trust this proposal will mature. It will add greatly to the value of the Institute as a training ground.

The Calcutta University has recently instituted a Doctorate of Science (Public Health) which will be a higher degree open to those holding the D. P. H. and will be obtainable after a year's study and research in some special subject in public health. A thesis on this subject will be submitted and a higher examination in the general aspect of public health also taken. Short courses of post-graduate instruction in special subjects for public health are also being arranged. These will be intended for public health workers in India desiring to refresh their knowledge in special subjects such as statistics, nutrition, malariology, etc. Such courses will be of about 3 months' duration, and it is hoped will be taken advantage of by members of provincial public health staff and others.

Mention has been made of the section of Maternity and Child Welfare. There is a great need in India for more doctors specially trained in Maternity and Child Welfare work. This work all over India has grown up sporadically without much forethought, planning or co-ordination, and mostly by voluntary agencies who deserve great credit for initiating the work. The need for trained women graduates who could take charge of the work and direct and develop it on proper lines has been felt, and hitherto the only means of obtaining such training was to proceed to London or elsewhere. The Faculty of Tropical Medicine and Hygiene of Bengal in 1933 decided to create a Diploma in Maternity and Child Welfare to be given to women graduates after examination and a course of training in the Institute. One course has already been held in 1933 and another is now under progress. A scholarship for a woman graduate for this course has been kindly given by Dr. Margaret Balfour during both the courses.

Courses held.—The first course for the D. P. H. Class based on the Institute was held in 1932-33. The class was 24 in number and composed as follows:—

Medical graduates (practitioners)	19
From the staff of the Calcutta Corporation	1
Burma Public Health Service	2
Indian States Public Health Service	2
	24

Of the 24, 18 came from Bengal.
1 came from Bihar and Orissa.
2 came from Hyderabad.
1 came from Coorg.
2 came from Burma.

Of these, 23 appeared in Part I of Calcutta University and all passed. Of these, 20 passed in Part II.

The session 1933-34.—For this course, the training was definitely formulated and prospectuses issued. The course for the D. P. H. and Hygiene of the Faculty of Tropical Medicine and Hygiene was opened,

and also for the Diploma in Maternity and Child Welfare. For the D. P. H. 48 applications were received and 30 selected for the course. These came from the following provinces:—

Bengal	19
Burma	1
Hyderabad State	2
Punjab	2
Mysore State	2
Travancore State	2
Bihar and Orissa	1
United Provinces	1
Total	30

It will be seen that though the majority of applications entertained came from Bengal, many of the provinces and States were represented.

For the session 1934-35.—Students have been entered who came from the following provinces:—

Bengal	11
Madras	3
North-West Frontier Province	2
Punjab	2
Burma	1
United Provinces	1
Indian Medical Department	1
Eastern Bengal Railway	1
	22

Research and Investigation.—The problem of cholera is one of the most pressing in India and it is fitting that the Institute during the first year of the existence should have devoted considerable attention to this disease. Certain areas of India constitute endemic reservoirs whence the disease spreads in epidemic form to other areas of India and thence at times to other countries. The study of some of its puzzling features therefore is not only of primary importance to India, but also to the world in general. Cholera is no new disease in India. The oldest records extant mention the disease. In 1503 an outbreak is recorded at Calicut and in 1543 an army at Goa was attacked. In 1783 it is stated that 20,000 people died of cholera at Hardwar. In 1817 occurred one of those explosive outbreaks in India which spread northwards to Afghanistan, Persia, Russia and Europe, and southwards to Ceylon and the Far East.

Brydon in 1870 made a careful study of the epidemics up to that time and reached the conclusion that cholera is dependent on an atmosphere of moisture, for epidemic invasion. Rogers independently in 1927

came to somewhat the same conclusions but correlated endemicity in India with average abolute humidity of the air. On these grounds he found the endemic areas in India to be:—

(*a*) Lower Bengal, Orissa and Assam which constitute a hyper-endemic area.

(*b*) Bihar, Chota Nagpur and part of the United Provinces.

(*c*) The low-lying districts of South East Madras.

(*d*) A small low-lying strip of the North Kambam district of Bombay.

While the first-named remains the main reservoir from which the disease is carried to other parts of India, the other three districts he considers play an important part in this connection.

The subject of the seasonal distribution of cholera in India is of considerable importance. In Bengal the cholera season is in the cold weather and early hot weather, while the disease is at a minimum during the monsoon. In the Ganges valley the disease is at its maximum later in the year as we go northwards, and in the Punjab and in the United Provinces the disease seems to be enhanced by the South West Monsoon.

Russell and Sundararajan in this connection made an exhaustive study of the relationships of climatic factors throughout India to cholera and state that " it is no longer theory to suppose that climatic factors have a definite relationship with the incidence of cholera in India. The association of high relative humidity with high temperature accompanied by intermittent rains forms the most favourable atmosphere for development of the disease. The presence of epidemic centres from which epidemics spring at short intervals is also a fact which must be accepted. No single factor however can be held responsible for the periodic waves of the disease which devastate the provinces of India, and it must be recognised that these waves are preceded by conditions too complex to admit of complete solution with the help of available data. Immediate susceptibility, foci of infection, favourable atmospheric conditions, fairs and festivals, carriers, insanitary habits, all play their part in a manner that defies analysis ".

The study of conditions making for endemicity or epidemicity is obviously one of extreme interest and importance not only to India but to the outside world. Since the cause of cholera is known, it was natural that the causes of endemicity and epidemicity should be sought in the vibrio itself. Agglutination by a high-titre serum as a fundamental diagnostic property of a ' true ' cholera vibrio was probably first laid down by Kolle and Gottschlich in 1903, and as late as 1933 was accepted by the Office International as one of the principal criteria in the recognition of the true cholera vibrio. It is to be noted however that Kolle and Gottschlich themselves found many discrepancies, but they attributed such irregularities to faults in plating-technique and to contaminations. Later results showed however that non-agglutinating vibrios were found under a variety of conditions which demanded closer study and interpretation. D'Herelle and others found such non-agglutinating vibrios in pilgrims at El Tor returning from the Hedjaz pilgrimage. D'Herelle was of opinion that as these vibrios had never been incriminated with outbreaks of epidemic cholera the persons carrying

them were therefore harmless. Tomb and Maitra and Brahmachari in India working in endemic areas found that the number of such non-agglutinating carriers progressed in number during the cholera season and diminished as the season declined. In 1933 Pasricha made a very definite contribution to the problem by finding that in the annual cholera season in Calcutta, the great majority of typical cholera cases at the beginning of the epidemic were non-agglutinating, that at the height of the epidemic agglutinating strains were universal, and that non-agglutinators again made their appearance at the decline of the season. This has made us revise many of our ideas as to the rôle of the non-agglutinating vibrio. Doorenbos's classification of endemic and epidemic types of vibrios does not, at least at present, seem justified. The whole carrier question has assumed great importance and a voluminous literature has developed in relation to it. It became obvious that there were a series of puzzling problems of a diverse nature relating to cholera which needed co-ordinated investigation and in 1931 proposals were made by the Indian Research Fund Association for the establishment of a Cholera Commission which would investigate the various aspects of the problem in India in a carefully co-ordinated manner. Unfortunately the financial crisis abruptly stopped this scheme, though research on various aspects of cholera still continued in India. The urgency of some co-ordinated investigation into certain aspects however was again brought forward in 1932 by certain findings in Syria where healthy persons coming from Iraq were found to be carrying agglutinating vibrios, and this despite the fact that many of them not only had been inoculated, but came from areas which were not infected with cholera. What was the significance and danger of such people and such vibrios? The matter, being one of international importance, was discussed at various meetings of the Permanent Committee of the Office International d'Hygiene Publique. At the May Meeting of 1933 which I attended as the representative of the Government of India, the matter was discussed fully and I conveyed the views arrived at to the Government of India. These were that the fundamental problems of vibrio character under conditions of epidemicity and endemicity could only be studied in India, and the same applied to the carrier problem. The Office therefore requested that the Government of India might start investigations into the particular points. In his note to the delegate from British India, the President of the Permanent Committee particularised the following points for investigation in India:—

(*a*) Do the vibrios in the intestine either of convalescent or healthy carriers properly so called, preserve or do they lose their pathogenicity?

(*b*) In what way is the virus of cholera maintained in the endemic regions during inter-epidemic regions, is it by means of one or other of these two categories of carriers or by both of them or otherwise?

(*c*) In an endemic region do vibrios in the intestine of a carrier which have been deprived of their virulence, recover their virulence and become the cause of the outbreak of an epidemic of cholera?

(*d*) In epidemic regions, is the rôle of convalescent or of healthy carriers the same, as in endemic regions?

(*e*) Is it possible for a healthy carrier in an epidemic region, to be the origin of a case of cholera?

(*f*) Has it been found possible to obtain a rapid sterilisation of cholera carriers and if so, by what means?

The Permanent Committee of the Office at this meeting passed the following resolution:—" It would be desirable that a technical Research Committee should be formed in British India in order to elucidate some obscure points in the cholera problem, among others the pathogenic significance of vibrio disseminated by carriers, according to their place of origin."

The Government of India referred this communication to the Indian Research Fund Association, which having already decided on the formation of a Cholera Commission in 1931, naturally gave the communication the most careful consideration. Though a Cholera Commission had not actually been formed, important work was being carried on in India into the phenomena associated with cholera phage in Patna under Dr. Ashesov, in Shillong under Lt.-Col. Morison and in Calcutta under Capt. Pasricha. Important chemical investigations into the structure of the cholera vibrio had also been commenced by Dr. Linton at the All-India Institute of Hygiene in Calcutta. In addition to the Working Committee on Cholera, the Scientific Advisory Board of the Indian Research Fund Association formed also an Advisory Committee on Cholera with the object of co-ordinating all the work to be done on cholera in India and it asked this Advisory Committee to frame proposals for work which would, if thought necessary and desirable, embody the proposals put forward by the Office. The Governing Body of the Indian Research Fund Association eventually agreed to proposals put up by the Cholera Advisory Committee on the lines of a scheme outlined by Lt.-Col. Taylor, D.S.O., I.M.S. This Enquiry is located mainly at the All-India Institute of Hygiene in Calcutta and comprises a field section in an endemic area under Dr. Lal, a bacteriological section in the School of Tropical Medicine and All-India Institute of Hygiene under Capt. Pasricha, a biochemical section under Dr. Linton in the All-India Institute of Hygiene and a clinical enquiry under Capt. Pasricha at the School of Tropical Medicine. A section at the Central Research Institute under the Director is also correlated with the enquiry, and the enquiries into bacteriophage at Shillong and Madras are also within the purview of the Advisory Committee.

One of the main objects of the enquiry is to collect vibrios from cases of cholera, convalescents, and carriers (so called). These vibrios are thus of known origin and related to definite happenings in the field. These vibrios are first isolated, and then passed on to Capt. Pasricha's section for further investigation as to the agglutinability and biochemical reactions. Particular and selected strains are then examined for their reactions to the various types of phage, and passed on to Dr. Linton for determination of their structure, and to the Director, Central Research Institute, for particular serological examinations, particularly with regard to their antigenic structure and their reactions to O and H agglutinating sera. (Dried O antigen has been suggested as a reliable differentiating agglutination reaction.)

These results are then pooled and correlated with the relationships to the original happenings in the field. In this manner it is hoped

to relate particular types of vibrio with particular happenings in the field endemic area. The problem of endemicity is also being investigated by statistical methods in the section of Epidemiology and Vital Statistics of the Institute.

The enquiry has not been established long enough to give pronouncements of definite value but a reference to the individual reports attached will show some of the lines along which the investigation is heading. Of particular interest we think is the grouping of vibrios suggested by Dr. Linton as the result of his studies. The vibrios fall into 6 groups according to the individual combinations of protein and carbohydrate. It is of interest to note that the large proportion of vibrios isolated from cholera cases fall into group I and that the El Tor vibrios which are agglutinable but apparently non-pathogenic are associated with the ordinary cholera vibrio by their carbohydrate (which may account for their agglutinability) but to water vibrios by their protein (which may account for their non-pathogenicity). Personally I regard Dr. Linton's work as a contribution of the greatest interest and importance to the classification of cholera vibrios and it is with some expectation that we look forward to seeing if the vibrios isolated from cases and carriers (carriers both associated with transference of disease, and those not so) will fall into Dr. Linton's groups with any consistency. A reference to Dr. Lal's Report will show that a study of endemicity on statistical lines is likely to elucidate very interesting facts. Endemicity of cholera is by no means uniform in Bengal, or even in the District of 24-Parganas which has a very high endemic figure. The analyses and investigations in this direction however have not gone far enough yet to make definite pronouncements.

I would draw attention to some features of interest in Dr. Wilson's Report in the Section of Biochemistry and Nutrition. This section was opened in March 1933 and a large amount of time has naturally had to be expended in organising and equipping the section. It will be noted that Dr. Wilson regards two lines of works as of fundamental importance, namely, an accurate knowledge of the basic composition (including vitamins) of all the ordinary Indian foodstuffs, and diet surveys of the different classes and communities. Without this preliminary information, it will be impossible to criticise or to offer suggestions for improving the nutrition of the community. In this he is in agreement with Sir Robert McCarrison whose ambition it was to establish a Nutritional Institute in India, one of the main objects of which would be to conduct work along these two lines. The idea of a Nutritional Institute for India has unfortunately not yet fructified. Sir Robert McCarrison is on the point of retirement. On the appointment of his successor, early opportunity will be taken to discuss the work to be carried on at the Nutritional Institute at Coonoor and at the All-India Institute of Hygiene so that co-operation may be maintained, work rendered complementary, and unnecessary overlapping if possible avoided. This basal work involves a great deal of routine work and Dr. Wilson has been able to enlist the services of a number of enthusiastic voluntary workers.

Dr. Ahmad, the Assistant Professor of Biochemistry and Nutrition, has already done a considerable amount of work in the Institute on the vitamin contents of various foodstuffs. Shortage of vitamin C is probably one of the commonest nutritional faults of Indian dietaries and

Dr. Ahmad's work in this respect is very apposite, and his results should prove helpful and important to the public and to those who have to frame dietaries. The reduction method used by Dr. Ahmad he has found to give results in agreement with biological methods of testing, but there are some points in connection with this method which require further working out and Dr. Ahmad is engaged on this. Dr. Ahmad's work on carotene, its storage, and its transformation within the body is also worthy of note. I would draw attention to the interesting work on the relationship between radioactivity in water (and possibly foodstuffs) and vitamin deficiency being carried by Mr. N. K. Chatterjee under Dr. Wilson's guidance. These experiments seem to indicate that radioactive spring waters from Bengal may prevent and cure the early symptoms of vitamin deficiency such as xerophthalmia. Further work is necessary before any definite pronouncement can be made but the work hitherto done is suggestive and interesting.

Sir Robert McCarrison's work on the production of urinary stone in rats by faulty dietaries is well known. Work based on this is being carried out by two voluntary workers, the underlying idea being to compare the composition of the urine of subjects living on Bengal and Punjab diets, in order to see whether an explanation on these lines may be forthcoming to account for the rarity of urinary calculus in Bengal and its comparatively common occurrence in the Punjab. Other interesting points will be found in Dr. Wilson's report.

The Department of Malariology and Rural Hygiene under Dr. Krishnan has now been equipped with all the necessary equipment both field and laboratory for demonstrating methods of malarial investigation and control to post-graduates. This is of great importance as students proceeding to the D. P. H. should be fully acquainted with methods of investigation and control of the principal disease in India, *viz.*, malaria. It is necessary therefore to have a field station attached to the Institute and it is hoped that this will soon be established. Dr. Krishnan has continued his interesting work on the relationships of the reticulo-endothelial system to malaria and blackwater fever. I would refer those interested, to his report and to his published papers. Hæmoglobinuria is apparently the result of two factors, the destruction of a large number of infected red cells by the malarial parasite, and the shedding of hæmoglobin products into the blood from these cells owing to the absence of a sufficient number of phagocytic reticulo-endothelial cells. Hæmoglobinuric fever is thus associated with questions of immunity or tolerance to the malarial parasite, with the production of intense infection, with treatment with quinine and with the mechanism of production and action of reticulo-endothelial phagocytes. Dr. Krishnan is at present investigating these points, especially with a view to treatment, in monkeys infected with malaria; and it is hoped valuable results may emerge which will be applicable to blackwater fever in human beings. The department has also given useful assistance to outside bodies.

I have already noted that the department of Maternity and Child Welfare was kept in abeyance by the Government of India owing to financial stringency, but that the Countess of Dufferin's Fund and the Red Cross had kindly come forward and offered to start the Section. This offer was gratefully accepted and Dr. Orkney has directed and controlled the section during the year. The initiation of a Diploma in

Maternity and Child Welfare by the Faculty of Tropical Medicine and Hygiene of Bengal has already been mentioned, and one of the main reasons for the Dufferin Fund Committee in partially financing this Section was to provide facilities for training post-graduates in this Diploma. Dr. Orkney's observations on the necessity for and desirability of such a diploma will be noted. One class has already been held and another is in progress. An essential part of such training is district work and facilities for this have been provided by the establishment of a Maternity and Child Welfare Clinic in Ward 8 which is close to the Institute. This Clinic is popular and doing good work in the Ward: it is assisted by grants of money and milk from the Calcutta Corporation and it has been possible to extend its activities largely, and to add a Nursery School and a nucleus of school medical inspection by a grant from the Calcutta Health Week Committee, to which we are naturally very indebted and grateful. I have been Chairman of the Exhibits Committee of the Health Week Exhibition for some years and the Institute has given all possible assistance to this important educational and propaganda movement. Dr. Orkney notes that there is material for research available but owing to the straitened finances of the Section it has not been possible to do anything in this direction.

I would like to place on record my gratitude to the Countess of Dufferin's Fund, the Red Cross Association, the Calcutta Health Week Committee, the Calcutta Corporation, the Indian Football Association, Mr. Birla, Mr. Khaitan and other generous donors to the Funds of the Clinic attached to this Section, and it is hoped that the financial situation may improve soon, so that the Government of India may be able to place the Section on the basis that was intended in the beginning.

Tuberculosis Research under the Indian Research Fund Association.—This enquiry under the auspices of the Indian Research Fund Association and financed by it, has been carried on by Dr. A. C. Ukil since 1928, and in 1932 accommodation was provided for it in the Institute.

Tuberculosis is one of the main public health problems in India ranking probably next to malaria in this respect, and it is appropriate that investigations into its epidemiology and other features should be housed in the Institute of Hygiene. It is difficult to state at what stage of the present epidemic of tuberculosis we are in India. So far as phthisis is concerned, the type of disease tends to be acute, and the greatest mortality occurs in comparatively young adults. Accurate figures are wanting for comparison but it would appear probable that the peak of the epidemic has not yet been reached in India. Such urbanization and industrialisation as have occurred in India have, in all likelihood led to an increase in the incidence of phthisis. Dr. Ukil has shown, using the cutaneous tuberculin test, that the infection rate varies between 21 and 76 per cent. according to the density of population, giving an average of 46 per cent. A somewhat similar figure was obtained from the autopsies carried out at the Calcutta Police Morgue.

Dr. Ukil has shown that the remarkable absence of tuberculosis in mortality figures in infants in India is probably more apparent than real. From an extensive examination carried out over the last four years, Dr. Ukil is of opinion that the extent of tuberculisation of the population in India to-day is midway between that of the African races

and the highly industrialised and urbanized European races, and that India and China are probably on the same level. Dr. Ukil has found no bacilli of the bovine type in either glandular or osteo-articular lesions. The reactions of various classes of individual in India to infection have been carefully studied. In rural areas, predominantly exudative lesions are found, while the urban populations usually show a more productive type of lesion. The rôle that allergy and immunity play in phthisis amongst Indians is the subject of present investigation. The possibility of application of inoculation with B. C. G. bacillus is being studied. Dr. Ukil is attached to the Medical College Hospital where there is a large outdoor department devoted to tuberculosis. He is also in close touch with the Tuberculosis Association. He is therefore in a very favourable position for the investigation and study of tuberculosis in India.

The researches in kala-azar and in leprosy are also accommodated in the Institute but as they are under the Director of the School of Tropical Medicine, their reports are included in the Reports of the School. An important investigation into the presence of *A. ludlowi* in the vicinity of Calcutta which is being carried out by the Public Health Department of Bengal is also housed in the Institute. This mosquito which normally breeds in brackish water was known to exist in the Southern Sunderban areas of Bengal. In 1931 however a severe outbreak of malaria about 20 miles from Calcutta was found to be due to its presence. An investigation by the Bengal Public Health Department was instituted and it was found that *ludlowi* had taken on migrating habits and was being carried by country boats to the neighbourhood of Calcutta. The enquiry is undertaking preventive measures as well and when complete it will form a most interesting chapter in malarial biology.

Qualifications required by Provincial Governments of candidates for provincial sanitary staffs.—In the earlier part of my report I referred to the appointment of provincial sanitary staffs and I would revert to the matter again with particular reference to the question of the qualifications which are now being demanded of candidates for appointments on provincial sanitary staffs.

The development of provincial public health departments may be said to have begun in 1912 when the Government of India gave grants towards the appointment and augmentation of sanitary staffs in provinces. These staffs may be classified as follows:—

(*a*) Municipal Health Officers.

(*b*) District Health Officers.

(*c*) Assistant Directors of Public Health.

(*d*) Directors of Public Health.

(*c*) and (*d*) may be termed superior appointments and demanding as a rule more experience, ability and administrative capacity than (*a*) and (*b*).

At this time (1912) there was no provision for obtaining higher training and qualifications in sanitary science and public health in India, and the higher appointments in the provincial health services were of necessity filled by medical officers possessing a higher qualification in

public health (usually the Diploma in Public Health) obtained in the United Kingdom or elsewhere. The Government of India in their resolution of 1912 insisted that candidates for Assistant Directorships of Public Health should have a British Diploma of Public Health and a registered qualification. Health Officers of first class towns were required to have a registered medical qualification and a British Diploma of Public Health. The Government of India in their resolution stated: "The necessity for a British Diploma will however only be temporary as the Government of India trust that it may be possible to waive the second restriction as soon as arrangements can be made in India which will enable Indians trained in this country to become health officers of the first class. For health officers of the second class the main qualification will be a good general education supplemented by a course of training in public health approved by the local Government." In view of the implication of this statement provincial governments and universities naturally addressed themselves to the question of providing post-graduate training and qualifications in public health. Higher qualifications demanding certain courses of training were initiated at the Universities of Bombay, Madras, Calcutta and Lucknow. These were perhaps essentially provincial in outlook and intended at least in the first instance for the training of District and Municipal Health Officers in their own province.

The Reforms Act of 1919 gave provincial autonomy and independence of action in public health matters within provincial boundaries. The orders of the Government of India referring to the qualifications of the sanitary staff in provinces contained in the resolution of 1912 were then no longer binding. Some provinces have still adhered to these rules either in whole or part while others have broken away entirely from them. Below I give a statement of the present position in provinces with regard to the qualifications required of candidates for appointment to the sanitary staff in the various provinces:—

The Government of Madras insist at present on their Assistant Directors of Public Health possessing a D. P. H. obtained in Great Britain and if an Assistant Director of Public Health is appointed without such, he must proceed to Great Britain for 9 months and obtain a Diploma of Public Health there.

For the District Health Officers, D. P. H. or B. S. Sc. or its equivalent obtained in India is accepted as sufficient.

In the *United Provinces* similarly, a British D. P. H. is necessary for the appointments of Assistant Directors of Public Health. This is not insisted on for District Health Officers.

The Bombay Government—a British D. P. H. is necessary for Assistant Directors of Public Health. For District Health Officers also a British D. P. H. is required though the revision of this rule is being considered whereby a D. P. H. of an Indian University or its equivalent may be accepted as the minimum qualification. For Municipal Health Officers a D. P. H. obtained either in India or elsewhere is insisted on.

In Burma the Assistant Directors of Public Health at present possess British diplomas. Though there is no rule to this effect, it is carried out in practice at present. For District Health Officers and Municipal Health Officers the D. P. H. obtained in India is accepted.

The Bihar and Orissa Government accept either British or Indian diplomas for District Health Officerships.

In Bengal any D. P. H. either British or Indian is accepted for all health appointments in the province.

In Assam for Assistant Directors of Public Health a British D. P. H. is required. For District Health Officers and Municipal Health Officers an Indian D. P. H. is accepted.

A D. P. H. obtained in the Calcutta University after a course at the All-India Institute of Hygiene and Public Health, Calcutta, is accepted as sufficient for Chief Medical Officerships of the Indian Railways.

With the provision of facilities for training now available in the School of Tropical Medicine and in the Institute of Hygiene specially devoted to teaching and research in the public health problems of India, it is obvious that the situation has changed, and it may be opportune to take stock of the position at the present time. The main point for consideration is whether the possession of a D. P. H. obtained in the United Kingdom or abroad should be considered essential to a candidate for appointments to the superior or other staff in provincial public health departments. It may be pointed out that the course of training for the D. P. H. in the United Kingdom is largely and purposely designed to turn out capable assistant medical officers of health for work in the *United Kingdom* and not elsewhere. Instructions in the problems of the epidemiology and prevention of tropical diseases such as malaria, cholera and kala-azar must, if given at all, be largely theoretical. The value of training (and the same applies to experience) in a country where environmental sanitation is of a high standard should of course be great. It is a matter for consideration however whether the possession of a D. P. H. obtained in the United Kingdom or elsewhere is *of itself* still an essential for an officer in any appointment of a provincial sanitary staff, taking into consideration the facilities now available in India for instruction and practice in public health problems.

In my opinion the Diploma of Public Health acquired at the School of Tropical Medicine and at the Institute of Hygiene should now be considered as actually preferable to a D. P. H. obtained abroad. I do not mean to depreciate the value of experience abroad. This will always be extremely valuable to the observant student. I think that local Governments which still insist on the possession of a D. P. H. acquired abroad for the superior appointment in their sanitary staffs should reconsider the position if they have not already done so in the light of the present position. The Railway Board for instance have recently decided that a D. P. H. obtained after study at the All-India Institute of Hygiene will be accepted for appointments of Chief Medical Officer in the Government Railways.

The All-India Institute of Hygiene has been established with the express intention of training medical men as efficiently as is possible in the problems of public health in India. It is our intention to fulfil this purpose in the best manner possible. The Institute however cannot develop its fullest possibilities nor establish its reputation fully as long as local Governments insist on the possession of a D. P. H. obtained outside India for the higher appointments, for the best students will thus be prevented from taking their training at the Institute.

The Institute is now in touch with all the health movements and activities in Calcutta. It is utilised for meetings and lectures on many subjects. The Calcutta Health Week, the Tuberculosis Association and the Leprosy Committee held their meetings in the Institute, and recently a course of lectures to post-graduates in leprosy arranged by the King George Thanksgiving Fund was held here. The museum is now being established and though mainly intended for teaching it will contain a certain amount of educative matter suitable for the general public.

In conclusion I would thank my staff for their willing co-operation and assistance. In particular I am particularly grateful to Lt.-Col. A. A. E. Baptist, M.B.E., I.M.D. (RETD.), Assistant Director, who has continued to give invaluable services to the Institute.

REPORT OF THE PROFESSOR OF VITAL STATISTICS AND EPIDEMIOLOGY.

[Dr. R. B. Lal, M.B., B.S., D.P.H., D.T.M. & H., D.B.]

This is the first report from the Department. I took charge of my duties on the 10th January 1934 and Dr. Raja reported his arrival on the 6th February 1934. Mr. Das Gupta was appointed laboratory assistant on the 23rd February 1934.

Teaching.—The course of studies in Epidemiology and Vital Statistics for D. P. H. students as laid down by the University and stated in the prospectus of the Institute prescribed twenty lectures on the subject. In actual practice it was found impossible to cover the ground in such a short course. A schedule of lectures, demonstrations, practical laboratory work, and tutorial classes was drawn up which took over 100 hours to complete. Due to Col. Stewart's absence on leave, lectures on Indian Sanitary Law were delivered by Dr. Raja, and those on Disinfectants, Evolution, and Genetics were given by me. I also delivered a few lectures on Hygiene to the D. P. H. and L. T. M. classes.

Research.—Soon after my arrival I was associated with the Cholera Carrier Enquiry under I. R. F. A. and the planning and organization of the Field Section and Statistical Enquiry were entrusted to me. I visited Asansol Mining District and Diamond Harbour Sub-Division of 24-Parganas with a view to selecting a suitable area for locating the field enquiry. A group of sixteen villages in Diamond Harbour Sub-Division was finally selected and work was commenced in the last week of June. In this connection I gratefully acknowledge the help of Dr. R. B. Khambata, Director of Public Health, Bengal, who specially called a conference of his Assistant Directors to personally supply me with necessary information about their respective circles and of Mr. Sen, Chairman of the District Board, 24-Parganas, who extended his help and co-operation to the members of the field unit.

Statistical Enquiry.—This investigation was taken up with the object of studying the factors concerned in the endemicity of cholera. It was soon found that the political divisions which had so far been taken as units for studying the natural history of cholera were composed of very heterogeneous elements with regard to their cholera experiences and no basic study on the problem of endemicity could be fruitful unless it was based on homogeneous units. The smallest registration units, *viz.*, *thanas*, were, therefore, taken up for individual study. Cholera mortality figures of Bengal by *thanas* for 32 years (1901-1932) were collected from the records kept by the Director of Public Health, who very kindly gave me the loan of his registers.

Calculation of the population of areas relating to the registration of deaths was, however, not a simple matter. It was complicated by the fact that numerous administrative changes had taken place altering the boundaries of contiguous *thanas* during intercensal years, at times leading to the disappearance of some and reappearance of others. So far, detailed investigations have been limited to the following districts:—

Howrah, 24-Parganas, Hooghly, Midnapore, Burdwan, Nadia, Jessore, Khulna, Bakarganj, Birbhum, and Bankura.

On studying the average experience of individual *thanas* with regard to their mean mortality and monthly and yearly variations in cholera mortality, it was found that—

(1) In the major portion of these districts mean cholera mortality rates varied between 2 to 3·99 *per mille*. The western portions of Burdwan, Bankura, and Midnapore districts had experienced a low cholera mortality while south-western parts of 24-Parganas had suffered most severely and parts of this district and those of Howrah and Midnapore immediately surrounding this area had also fared badly. Patches of higher or lower mortality than the contiguous areas were found irregularly distributed.

(2) With regard to seasonal variations, the western districts were predominantly of the vernal type, but the central and eastern parts though mostly of the autumn-winter types were much less homogeneous.

It was felt that these observations were not sufficient to fully describe the epidemiological characteristics of the *thanas* and a more detailed analysis was required. R. A. Fisher's method of analysis of variance was found to be eminently fitted for this purpose because, by this technique, we were able to separate out the total variability in cholera mortality of any one *thana* into three portions:—(1) that relating to months or seasonal fluctuation, (2) that relating to years or secular fluctuation, and (3) a residual consisting of all other factors. When different centres were compared, the third portion of the variability could be further split up into that due to (1) forces which had special influence on the centre in question and (2) forces which acted in common. These studies, it is hoped, will reveal some of the mysteries in connection with the endemicity of cholera and will provide a sound basis for forecasting epidemics.

Field Enquiry.—This section forms a part of the Cholera Carrier Enquiry and has been organised with a view to:—

(1) Making a detailed study of the actual happenings which determine the origin, progress and termination of cholera outbreaks in an endemic area with special reference to the part played by cholera carriers.

(2) Providing material for a detailed bacteriological study of vibrios isolated from cases, contacts, and healthy persons living under natural village conditions about whom detailed information of epidemiological interest has been systematically recorded and further information could be obtained as desired.

(3) Determining the personal and environmental conditions conducive to the carrier state.

The community selected for this study resides in sixteen villages in Diamond Harbour Thana and has a population of over 10,000. A detailed epidemiological survey of the entire population was completed. The data were recorded on standard schedules which were specially designed to ensure uniformity of observation, easy recording, checking and analysis. The records consisted of relevant information regarding

each individual's identity, his general health, gastro-intestinal complaints, previous cholera history, immunity status, source of water supply, normal diet including imported food, chances of exposure to infection and its dissemination and a few items regarding his immediate environment. A systematic periodical examination of the identified stools of these people has also been carried out with the object of securing recent information about their carrier condition and of being in a position to trace the origin of the epidemics to them. A detailed investigation on the source of infection was carried out on the occurrence of each case of cholera or diarrhœa. Basic study of the organised data, which is being systematically recorded and analysed, will, it is hoped, lead to a better understanding of the mechanism of the incidence of cholera in endemic areas and the rôle played by the vibrio carriers in this connection. In fact, in the course of two outbreaks of cholera which have occurred during the period of investigation, a certain amount of evidence has already been collected which definitely suggests the carriers as the most probable source of infection in a few cases arising in the house. It is expected that on correlating their studies with the results of the laboratory investigations on the vibrios isolated in the field, which are being carried out in other departments, the complicated cholera carrier questions will be solved.

Equipment.—This Department has now been fully equipped with calculating, adding and accounting machines, as well as a Powers Samas sorting machine. These mechanical devices enable us to undertake systematic and comprehensive analysis of data collected by field investigations on standard lines. The Leprosy Department has already availed themselves of these facilities and for their benefit suitable schedules adopted for analysis by the Powers Samas system have been prepared. The mass of data concerning tuberculosis collected by the Chest Department of the Medical College is also under examination.

The data collected in connection with the field studies and the system of analysis evolved, now provide us with useful material for demonstrations to the students.

Acknowledgment.—I owe a great debt of gratitude to Lt.-Col. A. D. Stewart and to Lt.-Col. A. A. E. Baptist for their kindly providing me with all facilities to develop the Department. I am glad to acknowledge with thanks the help and co-operation received by me from Dr. Raja and other members of the staff. The names of Mr. Satya Swaroop, Mathematical Assistant in the Statistical Enquiry, who, through his ability and enthusiasm for work, has been a source of inspiration for his colleagues, and of Dr. J. K. Bhattacharya, who by his winning manners and interest in his work has gained the confidence of the rural population and carried out the field work under difficult circumstances, require special mention. I am also grateful to Mr. K. B. Das Gupta for his devotion to duty and loyal co-operation.

REPORT OF THE PROFESSOR OF MALARIOLOGY AND RURAL HYGIENE.

[DR. K. V. KRISHNAN, M.B., B.S., M.R.C.P., D.B., D.SC.]

The department of Malariology and Rural Hygiene may be said to have commenced its activities on the 9th February, 1934, when I took over charge of the department.

Staff.—The full quota of staff arrived gradually in the course of a few months following the commencement of the department. Assistant Professor, Dr. B. N. Ghosh, joined the department last of all on the 5th of June. At present the staff consists of the Professor, the Assistant Professor, two laboratory assistants and one peon.

Teaching.—One of the chief functions of the department is to deliver lectures on Malariology, Tuberculosis and Venereal Diseases to the post-graduate students at the Institute.

During the first few months of the existence of the department, most of its time, was occupied in getting the necessary equipment ready for the laboratory and in the preparation of charts, diagrams and synoptic tables for the lectures and in the collection of specimens for the practical classes and the museum.

The classes began in April and 20 lectures and 10 practical classes were given on the above subjects.

On account of Col. Stewart's absence on leave out of India this year, forty-five lectures on Tropical Hygiene and Infectious Diseases were delivered to the L. T. M., D. T. M. and D. P. H. students. Field training was given to these students at Asansol and Jamshedpur in Industrial Hygiene and Public Health Organisation and at Naity in Hooghly District on Malarial Survey and Control.

In connection with teaching I would like to place on record the difficulty experienced in providing proper field training in malariology this year and to request for an early establishment of a malaria field experimental station in one of the many heavily-infected villages within easy reach of Calcutta. When the classes began this year the problem of giving an adequate field training in malariology arose. As there was no malaria centre attached to the Institute where we could take the students and provide the necessary material for study and as there was not much time available, the help of the Bengal Public Health Department was sought, and a field station was temporarily started and practical training given there. It had a brief existence of four months and had to be closed down on account of insufficiency of subordinate staff and for want of funds for contingencies and travelling. It is needless to point out that field stations are maintained by every malaria teaching organisation in and outside India and that no malaria training is worth its name without a sound practical course in the field. Furthermore if, as is contemplated at present, a special three months' course in malariology is to be given every year at the Institute a field station would be indispensable and invaluable. Such a centre if established would not only help to raise the standard of training given but would also provide material for research in the laboratory and opportunities for observation in the field. Here I may point out that Bengal is an

ideal place for carrying out field research in malaria, and that some of the malarial problems if properly tackled would yield results of far-reaching importance not merely to Bengal but to malarious deltaic areas in other parts of the world as well.

Laboratory Research.—This forms a very important item of work of the department and at present we are engaged in the study of the blackwater fever problem. The following is a brief outline of the problem and of the work so far done.

Since 1929 I have been investigating the rôle of the reticulo-endothelial system in protozoal diseases in general and in kala-azar and malaria in particular and have so far published 15 papers on the subject. In the course of my investigations I obtained evidence to show that the reticulo-endothelial system probably played an important part in the aetiology and prevention of blackwater fever. In 1932 Napier and Campbell reported that, while in about 30 per cent. of *S. rhesus* monkeys infected with *P. knowlesii* haemoglobinuria was noticeable, the condition was completely absent in *S. irus* and *S. radiatus* monkeys. I showed through splenectomy in over 50 monkeys that the incidence of haemoglobinuria could not only be raised in *S. rhesus* monkeys from 30 to 80 or even 100 per cent. but also in *S. irus* and *S. radiatus* monkeys from 0 to 50 or even to 66 per cent. and thereby established the importance of the spleen and reticulo-endothelial system in the aetiology of haemoglobinuria. This work, which was being done by me under the auspices of the Indian Research Fund Association till the end of 1933, is now being continued at the Institute of Hygiene. The line of study engaging my attention at present is that regarding the factors responsible for the proliferation, mobilization and functional activation of the cells of the raticulo-endothelial system on which I believe that immunity in malaria probably depends. The rôle of cholesterol and other lipoids in malarial immunity is being studied because of the close association of lipoid metabolism with the reticulo-endothelial system. The electric charges of normal red cells, red cells infected with malarial parasites and reticulocytes are also being determined with a view to elucidating the mechanism of phagocytosis by the cells of the reticulo-endothelial system. The results so far obtained lead me to believe that further work on the same lines would through light not only on the mechanism of production of black water fever but also on the methods of its prevention and cure. The present position is that if that work has to be continued uninterruptedly and on a proper scale a small additional staff to help us with the physico-chemical aspects of the investigation will be required. The Indian Research Fund Association has been asked if they could provide the necessary funds for the purpose. If they do not sanction the funds the scope of the enquiry will have to be reduced and progress will be very slow. But in view of the great importance and urgency of the problem and in view of the good results obtained so far, I have every hope that the Indian Research Fund Association will give the grant asked for.

Field Research.—The field malaria centre during the short period of its existence, did a small piece of useful investigation work. A map of the village was prepared showing the distribution of breeding places, anophelines, infected houses and carriers. The spleen and parasite indices of the whole population of 1,200 persons were also ascertained. The spleen rate was 15 per cent. and parasite rate 5 per cent. This village

in previous years was considered to be one of the most healthy in the Hooghly District. In 1931 a severe epidemic of malaria occurred there and caused a high mortality. Ever since then, malaria has been endemic there and it would be interesting to watch if the epidemic recurs and if so what factors determine its onset.

Help to outside agencies.—*School of Tropical Medicine.*—In August, 1934, Dr. Muir informed us that cases of malaria were occurring among the durwans of the School of Tropical Medicine. These durwans were living on the School premises and had not been outside Calcutta for a number of months previous to their illness, and had never suffered from malaria before. The presumption was that they contracted the disease in Calcutta while residing in the quarters at the School. We investigated this question and conducted an anopheline survey of the Tropical School and its environs. In two water storage tanks which are close to the School *A. stephensi* were found breeding. Larvae of the same species were also obtained from some old tins and boxes containing water lying in the compound. Attempts at collection of adults of *A. stephensi* proved a failure. The breeding places were attended to and no more cases of malaria occurred.

Medical College.—In November 1934, Col. Boyd reported that cases of malaria were cropping up among the inmates of the old nurses' quarters of the Medical College and he requested us to do a survey of the area with a view to discovering the breeding places of *A. stephensi.* Examinations of all water collections in and around the quarters revealed that *A. stephensi* was breeding in some of the water storage tanks in the servants' quarters. On steps being taken to make these tanks mosquito proof, and to destroy the larvae present fresh cases of malaria stopped occurring.

E. I. Railway.—At the request of Sir Hassan Suhrawardy, Chief Medical Officer, E. I. R., we have been rendering assistance to the laboratory at Lillooah by identifying several specimens of adult mosquitoes sent by them to us. This arrangement has been of help to us in that it has enriched our collection of mosquito specimens.

Papers already published:

1. Observations on the mode of action of quinine in malaria. *Ind. Jour. Med. Res., 1933.*
2. The effect of splenectomy on the course of malarial infection in monkeys. *Ind. Jour. Med. Res., 1933.*
3. Immunity to malaria in monkeys and the effect of splenectomy on it. *Ind. Jour. Med. Res., 1934.*

Papers in the press:

4. Rôle of the reticulo-endothelial system in haemoglobinuria in monkeys.
5. Observations on reticulocyte changes in malaria and their significance.
6. Rôle of cholesterol in malaria and haemoglobinuria in monkeys.
7. Treatment of haemoglobinuria in monkeys.
8. The rôle of electrical charge in the phagocytosis of red cells.

Acknowledgment.—I wish to express my thanks to Dr. Khambata, Director of Public Health for helping us in running the Malaria Centre at Naity.

REPORT OF THE PROFESSOR OF BIOCHEMISTRY AND NUTRITION.

[Dr. H. Ellis C. Wilson, M.B., Ch.B., D.Sc.]

An account of the work carried out since taking up duty is one of initiation rather than accomplishment. As far as research is concerned the policy embarked on has been to make as complete an analysis of the Indian foodstuffs as is possible with the methods now available. Apart from a knowledge of the composition of foods as regards the three major constituents, protein, fat and carbohydrate, quantitative information is lacking in respect to the mineral and vitamin content. Only within the last few years has a technique, chemical or biological, been developed for estimating quantitatively the vitamin content of different food materials. This line of work although in the nature of spade work is absolutely essential before any detailed information of the relation between diet and disease can be obtained.

Complementary to this investigation is a dietary survey on quantitative lines of all or as many classes of the community as is possible. A certain amount of data has already been collected in this field. The importance of having definite figures of food consumption needs no emphasis. No accusation of food deficiency of the people can be made until such can be expressed in numerical terms.

This preliminary investigation has been very materially forwarded by the help of a group of voluntary workers, each taking up a particular part of the field. To those workers not only this department but also the Institute is greatly indebted.

Vitamin C content of foodstuffs and the metabolism of hexuronic acid (vitamin C).—Dr. Bashir Ahmad, the Assistant Professor, has elaborated the technique for estimating hexuronic acid by titration with the reduction indicator 2·6 dichlorophenolindophenol. He has shown the method to be reliable provided the titration is carried out within a minute. The method has been controlled by the complete recovery of a known addition of hexuronic acid to a food extract. By means of this method the vitamin C content of some 65 foodstuffs including fruits, vegetables, cereals, pulses, etc., has been made. He has shown that certain fruits of the citrous variety such as the Indian orange and lime are not so poor in vitamin C as has generally been credited. He has shown that storage of fruits particularly after being cut up may reduce the vitamin content, due allowance being made for reversible changes taking place in hexuronic acid which does not reduce its antiscorbutic value. Fresh foodstuffs were always used as far as possible. Among the fruits which were rich in vitamin C are papaya, pineapple, leechee, guava, fruits unfortunately which are not overextensively used. Among the fruits and vegetables which are poor in this constituent are onions, bananas, apples, melons, pears, peaches, plums and grapes many of which are widely used by the masses. Vegetables such as cabbage, radish leaves, karela, certain varieties of red pepper and spinach were all found to be rich in this vitamin, in contrast to the cauliflower, pumpkin and allied species. The effect of moderate cooking was found to decrease the vitamin content by 20 to 25 per cent.

The excretion of vitamin C and reducing substances in the urine under different conditions was investigated on several human subjects in the laboratory. The total excretion of reducing substances was found to be remarkably constant on a constant diet. In general it was found to vary with total nitrogen excretion. No variation in reducing power was observed with moderate variation in the vitamin C intake. Following a large ingestion of vitamin C a considerable increase was ultimately noted after a certain lag. This might appear to indicate that the tissues have a considerable capacity for storing hexuronic acid and that even with healthy subjects the deposits are not fully saturated.

It should be noted that a certain amount of the reducing power of the urine is due to other substances than hexuronic acid. It is hoped to take up this point later. The whole problem is of importance in regard to the vitamin C requirements of the human subject. Three papers are in course of publication on this subject.

Vitamin A content of halibut liver oils.—Dr. Ahmad, on account of some clinical observations which had been brought to his notice in regard to the alleged potency of certain imported halibut liver oils, made some estimations of their content of vitamin A by two separate methods, namely direct chemical estimations by means of the antimony-trichloride method and control observations by biological assay. His results showed that the vitamin content of the oils were considerably lower than was claimed.

Transformation of carotene into vitamin A.—Dr. Ahmad early in the year after taking up his appointment continued a line of investigation on the metabolism of carotene. He has shown that colloidal carotene when injected into the circulation of dogs, cats and rabbits is taken up largely by the liver, spleen and lungs. It was considered probable that the pigment was absorbed by the phagocytic cells of the reticulo-endothelial system which are well represented in the liver and spleen. A sample of the liver removed both before and some time after the injections showed little or no increase in the vitamin A content. The spleen however which is usually deficient in vitamin A was found to be comparatively rich in this substance. Dr. Ahmad concludes that the cells of the reticulo-endothelial system are probably concerned in the transformation of carotene to vitamin A (a change which certainly is effected somewhere in the tissues), an assumption which appears justifiable in view of the known rôle of this system in the formation of bile pigment from haemoglobin.

Investigation of diet devised by the Bombay Health Authorities.—At the request of the Bombay Health Week Authorities we have tested out the value (growth promoting and freedom from disease) of a special diet which has been elaborated by them. The diet has been devised to contain all the known essentials and at a minimum cost of production. The diet, when compared with a first-class dietary containing a large allowance of milk, was found to promote the growth of young rats fully as well as the standard one. A full report has been sent to the Bombay Authorities and the experiment is being continued with a view to observing its effect on freedom from disease, fertility, maternal mortality, mortality of young, longevity, etc.

Analysis of foodstuffs.—Mr. Mallick, a voluntary worker, has been engaged in estimating the general and mineral composition of a number of Bengali foodstuffs. He is now completing an analysis of the carotene and vitamin A contents of the more commonly eaten foods. Up to date some 60 different food sources including vegetables, cereals, pulses, etc., have been dealt with. His results have shown that greens such as spinach are good sources of carotene while the pumpkin, potato and root vegetables are poor in this constituent. Mr. Nandi also a voluntary worker has been similarly engaged on an analysis of the ash and calcium content of local foodstuffs.

Radioactive water and vitamin deficiency.—Mr. N. K. Chatterjee of the Bengal Public Health Laboratory has continued his work on the effect of radioactive waters on the symptoms of vitamin deficiency in rats. (This work has special reference to the natural radioactive spring waters in Bengal.) Up to date the experiments tend to indicate that such waters may prevent and cure the early symptoms of vitamin deficiency such as xeropthalmia. The duration of life appeared to be prolonged beyond what is usually experienced with vitamin A deficiency. Similar observations were made on the vitamin B deficient rats. This problem will have to be investigated further however before the various factors concerned can be elucidated. The effect of radioactive water in rats fed a goitrogenic diet is in course of investigation.

Atta and rice diets, investigation of factors favouring calculus formation.—Mr. S. L. Mookerjee along with Mr. J. N. Gupta, both voluntary workers, are investigating the absorption of rice and wheat (atta) at different levels of intake. The excretion of nitrogen, sulphur, calcium and phosphorus and the hydrogen ion concentration of the urine are being observed. The object of the experiment is to compare the composition of the urine of persons on Bengali and Punjab diets respectively with a view to elucidating the factors which favour the development of urinary calculus in the Punjab and its rarity in Bengal.

Preparation of vitamin B concentrates.—Dr. S. N. Ganguly, a voluntary worker, has been engaged in isolating preparations of pure vitamin concentrates of the B group from different sources. He has succeeded in preparing a concentrate of B_1 (antineuritic) and B_2 and/or a fluorescent flavine pigment with alleged B_2 properties. Vitamin B_4 is in course of preparation. These products will be used as controls in the assay of the vitamin B group in Indian foodstuffs. It is further hoped to investigate in more detail the symptoms of deficiency of the various components of the B group. This problem will be materially helped by the direct estimation of minute quantities of the fluorescent pigment in foods and tissues by a photometer, which I hope shortly to take up.

Diet Survey.—A diet survey has been carried out on a number of families and two orphanages one Hindu and one Moslem. To those we are indebted for their co-operation in obtaining the information desired. A full analysis of the data awaits a completion of the investigation on the quantitative composition of the foodstuffs. At present the figures indicate that they are low in protein, fat especially animal fat and notably calcium. This is obviously of particular significance with regard to children. Among the poorer classes a definite deficiency

of vitamin B is indicated. The caloric intake in general however appears to be adequate.

Blood proteins and leprosy.—Shortly after my arrival in the early part of the year I investigated at Dr. Muir's suggestion the albumen and globulin content of the blood in the different types of leprosy (cutaneous and nerve types). In both types there was a considerable variation in the ratio of the two proteins. In general when one protein was high the other showed a compensatory decrease and *vice versâ*. The total blood proteins hence remained remarkably constant. In no case was a proteinaemia noted. The cases examined were all negative to either the Kahn or Wassermann test.

Experimental scurvy.—Dr. Ahmad and myself are at present engaged in an investigation on the mineral metabolism in experimental scurvy. The suprarenal gland, particularly the cortex, is known to contain relatively large quantities of hexuronic acid which gradually disappear on a scorbutic diet. It is hence possible that there is a connection between scurvy and Addison's disease one of the features of which is a disturbance of sodium and potassium metabolism.

REPORT OF THE MATERNITY AND CHILD WELFARE SECTION, 1934.

[DR. JEAN M. ORKNEY, M.B., CH.B., D.P.H., W.M.S.]

The main work of the Section has been the training of students for the Diploma in Maternity and Child Welfare instituted by the Faculty of Tropical Medicine, Bengal, in 1933. The first and consequently more or less experimental course for the new diploma was completed during the year. In the light of this experience one or two minor alterations in the planning of the course were considered advisable and these adjustments have been effected for the session which started on 24th October, 1934.

Three students commenced the course in 1933 and two completed the training for the Diploma in July, 1934. Two more were admitted in October, 1934. The numbers are admittedly small but so is the demand for medical women possessing a public health qualification. The need for such trained administrative and executive officers is obvious to anyone who has inspected existing Maternity and Child Welfare Schemes with a seeing eye or who has given thought to effective means of controlling maternal and infantile mortality and disablement rates in India, but until the demand for expert workers approximates to the need, the numbers of students must remain small. Meantime the very existence of a diploma sanctioned by Government, is a valuable piece of propaganda, a stimulus to voluntary bodies and local authorities to reconsider their aims and achievements in the field of child welfare, to reorganise their schemes so as to make them more effective and to bring them more directly into contact with the other public health departments.

In addition to theoretical instruction, practical experience in Maternity and Child Welfare and school medical work is provided for the D. M. C. W. students. For this purpose a demonstration unit aiming at continuity in care of the individual from conception up to school leaving age has been organised in Ward 8, Calcutta.

Ward 8 was chosen because of its proximity to the Institute, because the population of Hindi speaking middle class people seemed to offer the best field for educative health work, because several large general and maternity hospitals are located in the area and because the Ward is small and compact enough to be adequately staffed on the limited income available.

The Maternity and Child Welfare service is already reaching over 50 per cent. of the pregnant women, all the children whose births are registered and most whose births are unregistered, all the children between the ages of 1 and $2\frac{1}{2}$ and some older pre-school children for whom a nursery school has been established. A trained midwife has been employed during the last 6 months of the year and despite the Rs. 10 demanded for her services, her time is now well occupied. The antenatal, intranatal, and postnatal services are fairly complete. Only the skeleton of a school medical service has been possible so far and for a limited period.

A Maternity and Child Welfare Scheme on similar lines is run at the Clive Jute Mill and serves to introduce to the students the problems of women in industry, maternity benefits, administration of creches

and the general social-welfare scheme required under industrial conditions.

The section was established for the twofold purpose of post-graduate teaching and research. It is fulfilling the former purpose only; for the latter it is inadequately staffed and inadequately financed. Teaching, administrative duties, and routine executive duties connected with school medical inspection and school clinics, and with the various consultation clinics under the Maternity and Child Welfare Schemes leave little time for systematic research; and while valuable information about conditions which influence maternal and child health is accumulating on the record cards at the Welfare Centres, the task of classifying and assimilating the facts gathered is meantime inevitably held in abeyance. Even then the inquiry is of a limited nature and the section cannot be regarded as fulfilling its dual function of teaching and research.

The Maternity and Child Welfare Department is one of the two sections at the Institute for which the Government has not found it possible to make budget provision. Statistical evidence of the need for Maternity and Child Welfare is overwhelming. Further, the national health and national wealth depend ultimately on the physical soundness, the mental alertness, and the social adjustment of the individual, and since these attributes are decided in childhood, the delay in the opening of a Maternity and Child Welfare Section is very regretable. It may not be expedient, however desirable, immediately to deflect large sums of money from curative to preventive medicine but it is surely a duty as well as wisdom to help voluntary or official bodies to initiate and develope effective local schemes by making it possible for them to secure the services of a trained personnel. The Women's Medical Service and the Indian Red Cross have shown their appreciation of the outstanding need of India for more abundant health by financing the section since May, 1933. During 1934 the resources of the section were materially improved by grants from the Calcutta Health Week Committee, the Indian Football Association, Calcutta Corporation and by donations from Mr. B. M. Birla and Mr. Khaitan and several other generous individuals. It seems neither fitting nor just that a section potentially so beneficial should have to struggle along under the handicap imposed by an uncertain and limited income.

Dr. M. I. Balfour, O.B.E. and the Maternity and Child Welfare Bureau, Indian Red Cross have during the past two years given scholarships for students attending the D. M. C. W. course. The training of public health workers is one of the soundest ways of spreading health knowledge and practice, and since the scholarships come to an end this year it is hoped that other benefactors will come forward to found scholarships.

I was on leave for five months of the year. Dr. Jean McLean ably carried on the field work during my absence

REPORT OF THE ENQUIRY INTO THE CHEMICAL STRUCTURE OF CHOLERA AND CHOLERA-LIKE VIBRIOS.

[DR. R. W. LINTON, PH.D.]

Financed by the Indian Research Fund Association.

The Cholera Inquiry of the Indian Research Fund Association was established in October, 1931, and carried on its work at the Pasteur Institute, Shillong, until May, 1932, when it was transferred to this Institute. Until March, 1934, it occupied the quarters of the Biochemistry Section and since then another chemical laboratory on the ground floor and a combined office and bacteriological laboratory on the first floor. The staff consists of the Officer-in-charge, two chemists, a bacteriologist, and three assistants.

The work which first engaged the attention of the inquiry was that on the specific carbohydrate substances of the cholera and cholera-like vibrios. By October, 1932, the composition of two distinct specific carbohydrates had been ascertained in a few organisms. Both of these proved to be complex polysaccharides which on mild hydrolysis yielded a monosaccharide which in some cases was galactose and in others arabinose. Further hydrolysis showed that the remainder of the polysaccharide consisted in both cases of an aldobionic acid made up of galactose joined to glycuronic acid.

In 1934 a third type of polysaccharide was found, the units of which appeared to be glucose alone.

The study of the proteins of the vibrios was commenced in April, 1933. The first work done was an analysis of the nitrogen distribution in proteins from a variety of strains. The results showed that no differentiation could be made on this basis, since the nitrogen distribution was very similar, and probably identical, in all of them. The next step was to apply the very delicate "racemization" method to these proteins, and by this means it was at once made evident that two closely-related but entirely distinct kinds of proteins were present in the vibrio group. Incidentally, it may be mentioned that Mr. B. N. Mitra, M.SC., of this inquiry has now found that at least one of the differences between the two proteins lies in the position of the arginine amino-acid in the molecules.

Given these two proteins and three polysaccharides, it was evident that we could group the vibrios on the basis of their actual chemical composition into six groups, and representatives of all of these groups have now been found. It was felt that such a classification might be a stable one and at the same time the classification would serve as a basis for studying any chemical changes which might accompany dissociation.

The two kinds of protein have been designated Protein I and Protein II. The types of polysaccharide may be summarised as follows:—

Constituents.	Sources.
Type I.—Galactose, an aldobionic acid consisting of galactose and glycuronic acid.	In many vibrios from cholera cases.
Type II.—Arabinose, an aldobionic acid consisting of galactose and glycuronic acid.	In a few vibrios from cholera cases, and in all the non-agglutinating water vibrios studied.
Type III.—Glucose only, no aldobionic acid.	In a dissociant [Rangoon Rough (2)], in an aberrant strain (Basrah II), and in Japanese strains of the 'middle' type.

With the apparently infrequent exception of the ' mixed ' strains discussed below, all of the vibrios have been found to consist of one of the three polysaccharides and one of the two proteins. On the basis of the various possible combinations of the proteins and carbohydrates the following groups of vibrios have been established:—

Group I (Protein I and Polysaccharide I) contains most of the vibrios isolated from clinical cholera.

Group II (Protein I and Polysaccharide II) contains some of the vibrios found in clinical cholera. These are, however, of somewhat less frequent occurrence than those of Group I. In its composition Group II is intermediate between the cholera vibrios of Group I and the water vibrios of Group III.

Group III (Protein II and Polysaccharide II) contains the non-agglutinating water vibrios.

Group IV (Protein II and Polysaccharide I) contains the El Tor strains and at least two other vibrios.

Group V (Protein II and Polysaccharide III) contains the dissociant Rangoon Rough (2) and Basrah II.

Group VI (Protein I and Polysaccharide III) contains the Japanese strains of the ' middle ' type.

The first three groups became evident as soon as the two proteins and the first two polysaccharides were found to exist. The existence of the fourth group was anticipated with confidence, and when the El Tor strains were studied it was found that they had this structure. Group V was formed when the glucose-containing type of polysaccharide was isolated in 1934, and it was then evident that a sixth group was possible, and its existence was predicted. When the Japanese strains were studied early in 1935 it was found that the ' middle ' type of strain fell into this group.

The six groups have accordingly been built up on the basis of the chemical findings, and we have been able in the cases of Groups IV and VI to predict that organisms having these particular chemical constituents would occur among the vibrios. In regard to the classification itself, we may point out that its special interest lies in the inter-relationships it reveals. Thus the Group II vibrios appear intermediate in structure between the cholera vibrios and the water vibrios, and the El Tor vibrios are also intermediate, but related to the water vibrios through the protein instead of through the carbohydrate constituent. By means of the classification we have been able to recognize strains having the El Tor structure in India, and it also shows that the vibrios of cholera, and of water, the El Tor strains, the Japanese strains and the dissociants form a single interlocking group.

We have carried on studies on vibrio variation and the accompanying changes in chemical constitution. These have indicated that dissociation in the vibrios does not have a single chemical basis, but that at least three factors are concerned:—

1. *Loss of specific polysaccharide.*—This is probably the chief basis for the usual smooth-rough and agglutinable-non-agglutinable variations. When a strain loses enough of

its polysaccharide it becomes rough and inagglutinable. The reaction is reversible, and when special methods of subculture are used it is possible readily to bring about a reversion to agglutinability, smoothness of growth and possession of a full quota of specific polysaccharide.

2. *Change in chemical constituents.*—In the series of vibrios known as the Rangoon strains we have found that a vibrio may give rise to a daughter strain in which the protein and carbohydrate constituents are both different from those of the parent, or in which the protein alone has changed. It is probable that strains occur in which the polysaccharide alone shows a shift, but up to the present time we have not found them. We are not yet able to determine whether these shifts are due to mutations in the geneticist's sense or whether all of the varying chemical forms were present in small numbers as such in the original strain.

3. *Displacement of one chemical type by another.*—The present case is illustrated by a strain known as Basrah III, and by the Japanese strains of the 'variant' type. The strain Basrah III appears to consist of two types of vibrios, each having the same kind of protein, but differing in the type of polysaccharide which they contain. The composition of the strain is not in equilibrium, but varies sometimes rapidly and sometimes slowly from a predominance of one type to a more or less balanced condition in which the organisms are present in about equal numbers. It is obvious that changes in serological reactions would follow such changes in chemical structure, and an antiserum made against the strain when one member was in the ascendancy might not agglutinate the strain at all, when after a few weeks or months the other member had gained the upper hand. It is possible in our opinion that the aberrant strains of vibrio which vary in the agglutination reaction from time to time are of this mixed composition.

The Structure of the Vibrios.—In addition to the work briefly summarized above, the Inquiry has also studied the structure of the vibrios themselves, by the method of differential extraction. Two fractions have been isolated, their chemistry studied, and the distribution of the specific polysaccharides in them and in the residue of vibrio protein determined. It was found that reducing substance was present in both the fractions and in the residue, and that the quantity in the latter was minute in proportion to the amount of the residue, which averaged 85 per cent. of the whole vibrio. The two fractions, on the other hand, were found to have propoftionately large amounts of reducing substance. There appeared to be a parallelism between the distribution of reducing power in the two fractions and smoothness as shown by the reaction with Millon's reagent. There was not however a parallelism between agglutinability and the polysaccharide distribution.

REPORT OF THE TUBERCULOSIS RESEARCH DEPARTMENT.

[Dr. A. C. Ukil, m.b.]

Financed by the Indian Research Fund Association.

This Inquiry was started in 1927-28. The laboratory attached to it was located in private rented buildings until April, 1932, when it was shifted to the All-India Institute of Hygiene and Public Health, where accommodation and facilities for work were very kindly offered by the Director (Lt.-Col. A. D. Stewart, c.i.e., i.m.s.).

Lines of work undertaken.—When work was commenced, practically nothing definite was known regarding the epidemiology, pathology and causal factors of the disease in India. Hence, attention was directed, in the initial stages, to mapping out the distribution of the infection (as determined by tuberculin test) in rural, semi-rural, urban and industrial areas in four provinces (Bengal, Behar, Assam and Madras) and to finding out the nature of pathological changes in autopsied bodies in the different provincial Medical Colleges in India.

In view of the fact that the course of the disease was generally found to be more acute than in European countries, experiments were undertaken to indicate the rôle of secondary bacterial flora in pulmonary tuberculosis in warmer climates. This was studied by the experimental reproduction of the disease in guinea pigs, in association with secondary aerobic and anaerobic micro-organisms isolated from the sputum of "open" pulmonary Tuberculosis cases. Attention was next directed to the determination of the types of tubercle bacilli isolated from extra-pulmonary lesions in man. In view of a complete lack of information about the incidence and character of and mortality from tuberculosis in infancy and childhood in this country, the matter has been receiving our attention for the last two years. A good deal of useful information has been obtained which throws light on the subject. The portals of entry of the tubercle bacillus in the human body and the histopathology of the disease have also engaged our attention for the last two years.

The correlation of radiologic and histological studies is leading us on to the study of the rôle of allergy and immunity in tuberculous infection and disease in this country, which are of great importance in ascertaining the character of tuberculous lesions and in assessing the prognosis of cases.

An attempt has also been made to determine the extent and intensity of extreme ultra-violet solar radiation in Calcutta and to ascertain and determine its biological effect in influencing tubercular infection in guinea pigs.

A list of papers dealing with some of these subjects is given at the end of this section.

Some of the main findings.—The following are some of the main findings obtained as a result of the work done on the above subjects:—

I. *Epidemiology.*—The infection rate, as ascertained by the cutaneous tuberculin test, on 6,500 persons among the general population, including

infants, children, students, females and mill-hands in rural, semi-rural and urban areas. It varies between 21·8 per cent. to 76 per cent., according to the agglomeration of population, giving an average of 45·9 per cent. The post-mortem evidence of healed ' initial foci ', as obtained by the microscopic, histological and bacteriological examination of the bodies of 93 apparently normal persons who had died of accident, murder or suicide and who were autopsied at the Calcutta Police Morgue, gave us a figure of 46·3 per cent.

The low infection rate of 24·9 per cent. in children between 0—15 years was found to rise to 69·8 per cent. in " contact " cases. Among children living in *intimate* contact with " open " cases, it has been found to rise as high as 71·4 per cent. to 88·3 per cent. It may be pointed out here that the Indian vital statistics reports do not give any data about tuberculous disease and deaths in infants and children. An investigation of " contact " children up to October, 1934, showed that out of 149 cases periodically tested by Mantoux test and X-rayed, 45 showed active infiltration of the lung parenchyma and 6 died during the period under observation with symptoms suggestive of tuberculosis. The evidence has further been verified by a few autopsies.

From a study of healed, latent and active lung lesions and from the cuti-reaction surveys, we are led to believe that the extent of tuberculisation of the population in India to-day is midway between that of the virgin African races and the highly urbanized and industrialised European races, and that India and China probably stand on the same level in this regard. India being chiefly a rural and agricultural country, this might be one of the reasons why the disease runs a more acute course in this country, particularly in the rural areas.

The relationship of the presence of palpable glands in neck, intimacy of contact with previous cases, the state of health and body-build, *purdah* system and other factors to the complexion of the disease has also been studied.

II. *The rôle of secondary bacterial flora in pulmonary tuberculosis.*— It was shown in one of our papers published in 1930 that secondary bacterial flora seemed to be richer in this country and that anaerobic association was detected in 25 per cent. of the cases. It was further shown that the association of aerobic with anaerobic bacteria isolated from the sputum aid each other's action and augment the lesions in inoculated guinea pigs in a fair number of cases. Our experimental work indicated that the association of secondary organisms heightens the virulence of the tubercle bacillus in inoculated guinea pigs. It is quite possible that the same phenomenon takes place in tuberculous cavities in the human body, apart from their action in hastening the tuberculous necrotic processes.

III. *Types of tubercle bacilli found in extra-pulmonary lesions.*—All the strains of tubercle bacilli isolated from glandular and osteo-articular lesions so far studied (90 strains) have turned out to be of the human type. It appears that bovine infection in man must be of extremely rare occurence in India to-day, but whether it will prove to have any correlation with a possible increase of infection and disease among cattle (which is also uncommon) in future, we are not yet in a position to pronounce.

IV. *Histopathology and the resistance factor in tuberculosis.*—Active tuberculosis of the lungs was found in 17·6 per cent. among 1,000 consecutive post-mortem cases autopsied at the Calcutta Medical College Hospital, primary intestinal ulceration in 5·1 per cent. and well-marked caseation of tracheobronchial glands in 26·1 per cent. of cases. The low figure of 5 per cent. for general and meningeal tuberculosis was probably due to the fact that, in the absence of a children's hospital in the city, such cases were probably missed.

The character of lesions in pulmonary tuberculosis in rural, semi-rural and urban areas has been studied from radiological appearances and from the histological examination of the lung tissues of autopsied pulmonary tuberculosis cases. It has been noticed that a majority of rural individuals show a predominantly exudative lesion and that a large majority of the urban patients show a productive lesion, while the semi-rural people occupy an intermediate position. For example, in a series of 500 X-ray-diagnosed pulmonary tuberculosis cases, out of 66 rural cases, 57 were of the exudative type and 46 were in stage III when they presented themselves for examination. Of 138 semi-rural cases, 103 were of the exudative type and of 286 urban cases, and 108 showed exudative lesions. Very few rural and semi-rural cases showed productive changes and the course of the disease was necessarily more acute among them.

The character of the lesions is also influenced by the size and frequency of the infecting doses and probably also by the virulence of the bacilli. The histopathological picture reflects, in a large percentage of cases, a large dose-insemination on an imperfectly immunised soil. The rôle of allergy and immunity in relation to these and other factors of epidemiological importance is now being studied.

V. *The action of solar radiation in influencing tuberculous infection and disease in the tropics.*—Our attention was directed to this subject by two or three facts noted previously, suggesting that the open air life with an abundance of sunshine might play a rôle in this connection. For example, we found that the infection rate, as determined by the tuberculin test, was almost the same in school girls between 6—15 years as among boys of the same age, but when the former began to observe *purdah* (partial seclusion away from open air and sunshine), *i.e.*, between 16—20 years, the cuti-reaction rate rose to nearly double that among boys of the same age.

As we did not know the diurnal and seasonal variation of the extent and intensity of extreme ultra-violet solar radiation under local conditions, we had to devise an accurate method of estimating it with the help of Dr. P. N. Ghosh, Professor of Applied Physics, Calcutta University. The spectrum was photographed every four hours from 8 A.M. to 4 P.M. throughout a whole year with a quartz spectrograph of standard type (Hilger E 3) having a standard iron arc, a hydrogen discharge tube with quartz end plates being used as the standard source of light. The photographic plates were analysed with the Moll recording microphotometer. The variation of intensity of the spectrum was analysed according to the method of Oernstein and his collaborators. The maximum ultra-violet intensity was found to occur between 12 noon to 3 P.M. in the day. The intensity value near about the region 3050 A. U. has been determined for the whole year. It shows that the intensity, in

this region, is highest in June and decreases rapidly on both sides towards May and July. The character of the curve for the months of March to July is quite different from that of the rest of the year. It was found that along with the increase in the ultra-violet region, there was also a proportionate increase of the heat rays. The intensity in the afternoon of April and May has been less than that in the morning of these months. In the remaining months of the year, the rising sun is always of lower intensity than the setting sun.

In order to see how far the solar rays influence the course of infection in inoculated animals, batches of guinea pigs were inoculated with 0·1 mg. of a known strain of human type of the tubercle bacillus. These batches, along with controls, were kept in the room, in open air and sunshine simulating natural conditions, and were also exposed to the sun's rays (both direct and through special filter glasses) which cut off the greater portion of the heat rays while admitting ultra-violet rays. A weekly weight record of all animals was kept and the average length of life noted. The animals were autopsied at different periods and the character of lesions noted. From the evidence thus far obtained, it appears that the degree of involvement of tissues is much less in animals exposed to filtered sun's rays (*i.e.*, chiefly ultra-violet rays), as compared with that in control animals. When the animals are exposed to direct sun's rays, the percentage and extent of the lesions seem to be slightly more than when kept in the room. There is slight variation when they are kept in " open air " surroundings. The heat rays have been found to be detrimental to the life of the inoculated animals. These are worth considering when we remember that the heat rays of the sun in this country are the strongest when the ultra-violet rays are the most intense (*i.e.*, between 12 noon to 3 P.M.), particularly from the point of view of their therapeutic application. The experiments have just been completed and the results will be published in due course.

VI. *Work with B. C. G. Strain.*—A certain amount of work with the B. C. G. strain of Calmette was carried out. Virulence experiments were first done which only confirmed the findings of European workers regarding its avirulence. An attempt was then made to see what classes and proportion of the people could be inoculated with protective doses of the same. It has not yet been applied here in infants, but we inoculated in 1933 a few young Indian boys who were taken to the factories of the Bata Shoe Company in Czechoslovakia. The result is being watched.

Work done in 1934.—A portion of the work done has already been included in the previous paragraphs.

During the year 1934, 163 ' contact ' infants and children below 15 years were examined by Mantoux test and X'rays. The main findings have been indicated above. Post-mortem evidence of active lung tuberculosis was found in an apparently healthy child aged 3 years, a child aged 1 year 8 months dying of marasmus and a child aged 1 year dying of suspected opium poisoning (=sudden unconsciousness due to miliary involvement).

In the histopathological studies, the lung tissues of 120 autopsy cases have been histologically examined and the findings compared with the roentgenological appearances in 500 pulmonary tuberculosis cases.

Since the publication of our paper on the types of tubercle bacilli in extra-pulmonary lesions in 60 cases (1933), 15 strains have been isolated from pus and pleural fluid, and 27 from post-mortem tissues (10 from cervical glands, 9 from tracheo-bronchial glands and 5 from mesenteric glands). All the strains, so far examined, show characters of the human type.

To find out how far the inhalation or the ingestion route operates for infection in this country, the various gland groups (cervical, tracheo-bronchial and mesenteric) and organs of the bodies autopsied at the Police Morgue are being examined histologically and by culture and animal inoculation to demonstrate the presence and source (bovine or human) of tubercle bacilli. 106 bodies have so far been examined and 32 strains of tubercle bacilli isolated.

The sunlight experiments, which have been continued since 1932-33, have just been concluded. The main findings have been indicated above.

Another subject to which we have devoted our attention for some time past is a comparative use of guinea pigs *versus* culture media for isolating tubercle bacilli from pathological materials and post-mortem tissues. Altogether 78 samples of pus and pleural fluid, 106 sets of tissues from 35 post-mortem bodies, 11 samples of sputum and 1 sample of faeces have been examined. 44 strains of tubercle bacilli have been recovered by direct culture and 22 strains by guinea pig inoculation. For culture, the materials were treated with various dilutions of acids and alkalies and were inseminated into Dorset's, Hohn's, Petragnini, crystal violet potato and crystal violet egg potato media. From the results obtained so far, it appears that the crystal-violet-egg-potato medium shortens the period and increases the percentage of successful cultures better than either guinea pig inoculation or any other medium alone.

Staff and Organisation.—The Officer-in-charge of this inquiry is a voluntary worker. He has been ably assisted by one to three medical assistants from time to time, according to the programme of work undertaken during a year, a laboratory assistant and a sweeper. The present staff consists of Dr. S. R. Guha Thakurta, B.SC., M.B., who has been an able and loyal assistant in the department since the year 1927, Dr. N. G. Mazumdar, M.B., who has been in charge of histological work since 1933, Mr. A. G. Sinha, Laboratory Assistant, who has been connected with the inquiry since the beginning, and a sweeper. I desire to express my thanks to all of them.

I take this opportunity of expressing my grateful thanks to the Director (Lt.-Col. A. D. Stewart, C.I.E., I.M.S.) for granting accommodation and facilities for work at the Institute. I desire to express my thanks also to the authorities of the Calcutta Medical College and Hospitals and the Tuberculosis Association of Bengal for help in various lines of the work.

Papers published under this Inquiry:

1. The incidence and types of tuberculosis met with in Bengal. *Trans. 7th Congress, Far Eastern Association of Trop. Med., 1927.*
2. Prevention of Tuberculosis in India, including a note on the B. C. G. Vaccine of Calmette. *Ibid.*

3. The epidemiology and pathology of tuberculosis in India. *Ind. Journ. Med. Res., Vol. XVII, No. 3, Jan., 1930.*

4. The rôle of secondary bacterial flora in pulmonary tuberculosis. *Ibid.*

5. Epidemiologie de la tuberculose aux Indes. *Bull, Soc. Path. Exotique, Tome XXIII, No. 1, Jan., 1930.*

6. A note on the epidemiology and pathology of tuberculosis in India. *Tubercle, March, 1931.*

7. Eine untersuchung über die Immunität der Inder gegen Tuberkulose. *Zeit. fur Hyg. u. Infektionskrankheiten, Bd. 112, Heft 1, 1931.*

8. How to assess the prognosis of lung tuberculosis cases in India. *Proc. Ind. Science Congress, Jan., 1933, p. 373.*

9. The choice of a Counter-stain in the Ziehl-Neelsen method. *Ibid* and *J. I. M. A., Sept., 1934.*

10. A note on the localisation and character of pulmonary tuberculosis in India. *Cal. Med. Coll. Mag., Vol. VII, No. 1, Feb., 1933.*

11. Types of Tubercle bacilli causing extra-pulmonary lesions in India. *Ind. Jour. Med. Res., XX, April, 1933.*

12. Tuberculosis in Infancy and Childhood. *Ind. Journ. Pediatrics, Oct., 1933.*

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LIEUT.-COL. A. D. STEWART, C.I.E., M.B., F.R.C.S.E., D.P.H., D.T.M. & H., I.M.S.

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LIEUT.-COL. A. A. E. BAPTIST, M.B.E., I.M.D. (RETD.)

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All-India Institute of Hygiene and Public Health, Calcutta.

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Lt.-Col. A. A. E. Baptist, M.B.E., I.M.D. (R). (Officiating from 15th April 1935 to 14th July 1935).

Dr. R. B. Lal, M.B.B.S., D.P.H., D.T.M. & H., D.B. (Officiating from 13th September 1935 to 31st December 1935).

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Assistant Research Worker—Dr. Phanindra Nath Bose, M.B., D.T.M., D.P.H.

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B.—Staff of the Calcutta School of Tropical Medicine.

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Assistant Professor of Pathology—Dr. Kalipada Banerjee, M.B. (CAL.), D.T.M. (CAL.).

Department of Entomology—

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Assistant Professor—Mr. Nihar Ranjan Chatterjee, M.SC. (CAL.).

C.—Special Research Staff (under the Indian Research Fund Association).

1. Cholera Carrier and Epidemiological Enquiries—

Officer-in-charge—

(1) Capt. C. L. Pasricha, M.A., M.B., B.CHIR. (CANTAB.), M.R.C.S. (ENG.), L.R.C.P. (LOND.), I.M.S.

(2) Dr. R. B. Lal, M.B.B.S., D.P.H., D.T.M. & H., D.B.

(3) Dr. R. W. Linton, ph.D.

(a) *At Headquarters*—

Research Assistant—

Mr. Satya Swaroop, M.A. (Resigned).

Mr. K. C. Basak, B.A. (CANTAB.).

Bacteriologists—

Dr. Srish Chandra Seal, M.B.

Dr. Promode Chandra Das, L.M.F.

(b) *Field Section*—

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Assistant Bacteriologist—Dr. Monoranjan Kar, M.B., D.P.H.

Sub-Assistant Surgeon—Dr. Chunilal Ganguly, M.B., D.P.H., D.T.M. (CAL.).

2. Cholera Clinical Enquiry—

Officer-in-charge—Capt. C. L. Pasricha, M.A., M.B., B.CHIR. (CANTAB.), M.R.C.S. (ENG.), L.R.C.P. (LOND.), I.M.S.

Bacteriologist—Dr. E. G. O'Flynn, D.T.M., I.M.D.

3. Cholera Inquiry—

Officer-in-charge—Dr. R. W. Linton, PH.D.

1st Assistant—

Dr. D. L. Shrivastava, D.SC. (on leave).

Mr. B. N. Mitra, M.SC. (Officiating).

2nd Assistant—Mr. D. N. Mullick, M.SC. (Officiating).

4. Tuberculosis Inquiry—

Officer-in-charge—Dr. A. C. Ukil, M.B.

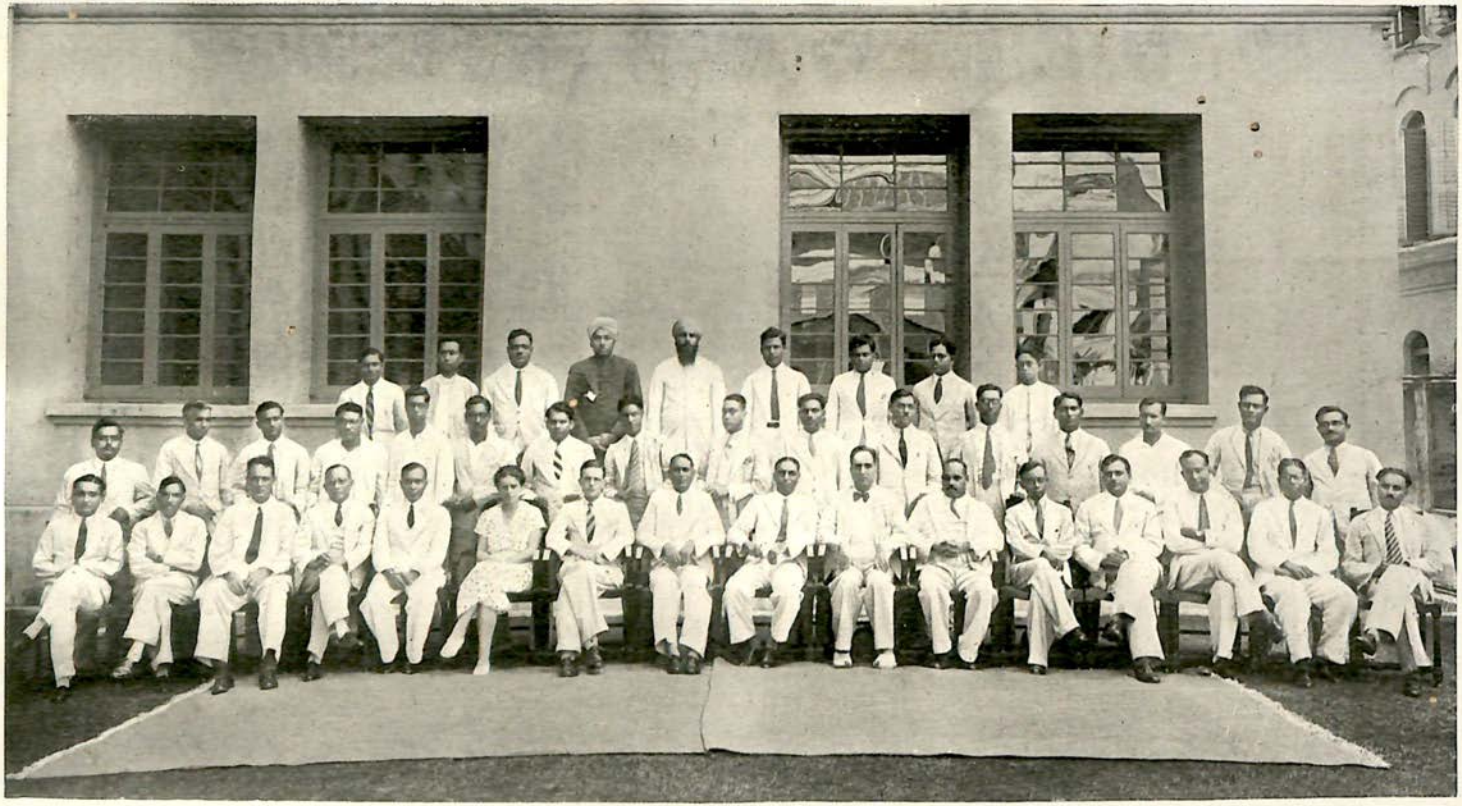
Medical Assistant—Dr. S. R. Guha Thakurta, M.B.

Histologist—Dr. N. G. Mazumder, M.B.

5. Malaria field Experimental station and Black water fever Enquiries—

Officer-in-charge—Dr. K. V. Krishnan, M.B.B.S., D.B., M.R.C.P., D.SC.

Research worker—Mr. N. Gopala Pai, M.A.



Sitting from left to right:—Dr. P. N. Bose, Dr. B. Ghosh, Dr. J. Lowe, Dr. S. Ghosh, Dr. A. K. Sen, Dr. M. I. Neal, Dr. H. Ellis C. Wilson, Dr. R. B. Lal, Capt. K. G. Mohile, Major S. D. S. Greval, Dr. K. C. K. E. Raja, Dr. B. M. Das Gupta, Dr. B. Ahmad, Dr. S. C. Ghoshal, Mr. B. N. Mitra, Mr. K. C. Basack.

Front row standing left to right:—Dr. D. Mitra, Dr. S. Raghavender Rao, Dr. L. S. B. Das, Dr. B. N. Shrivastava, Dr. P. N. Maji, Dr. K. B. Pradhan, Dr. L. N. Saxena, Dr. A. B. Ray, Dr. N. L. Mukherji, Dr. H. C. Varma, Dr. A. N. Pal, Dr. P. Das, Dr. K. P. Saxena, Dr. S. N. Paul, Dr. P. N. Chatterjee, Mr. Satya Swaroop.

Back row standing left to right:—Dr. J. M. Mathur, Dr. U. Thet Pe, Dr. E. Anantha Rao, Dr. D. D. Sharma, Dr. T. S. Chowhan, Dr. B. K. Nandi, Dr. P. C. Mukherji, Dr. Z. Ahmed, Dr. Maung U.

ANNUAL REPORT OF THE ALL-INDIA INSTITUTE OF HYGIENE AND PUBLIC HEALTH FOR THE YEAR 1935.

During the year under report the Institute was unfortunate in losing the services of three distinguished members of the staff. Lt.-Col. A. D. Stewart was on leave for the greater part of the year and during his absence Lt.-Col. A. A. E. Baptist acted as Director. On the 13th of September Lt.-Col. Stewart proceeded on leave preparatory to retirement and handed over the charge to me. The Institute has suffered a great loss due to his premature retirement. He was not only our first Director, but as Director designate he was associated with the scheme of the Institute from its very inception and was responsible for working it out in detail.

Col. Baptist who, as Assistant Director of the Institute, was closely associated with Col. Stewart in working out the details of the scheme and later in the administration of the Institute, shares the credit equally with Col. Stewart. His retirement on July 17 was a matter of sincere regret to his co-workers. Since his retirement the Institute remained without an Assistant Director till the end of the year and this added to the responsibilities of the Director.

Dr. Orkney, Professor of Maternity and Child Welfare, was transferred to Delhi as Director of the Maternity and Child Welfare Bureau. Her colleagues and co-workers will always miss her. Dr. Neal-Edwards relieved her on the 13th December 1935.

As was explained in last year's report the School of Tropical Medicine and this Institute are intimately associated in research and teaching. The demise of Col. Acton, which has robbed the School of Tropical Medicine of a great teacher, a brilliant research worker and a capable administrator, has been sincerely regretted by the staff of the Institute.

Dr. Muir, whose Leprosy Enquiry is located in the Institute, is also greatly missed by his colleagues.

The year under review, which was only the second year since the recruitment of the professorial staff, may be said to have witnessed steady and satisfactory progress in the achievement of all the objects for which this Institute was established. The primary function of the Institute is to impart post-graduate training in all branches of public health to the medical men and women who intend taking up public health as their career. It has, in other words, to provide the personnel for the municipal and rural health services of the country as well as for such special aspects of public health work as industrial hygiene, maternity and child welfare, school medical work, etc. The courses of study that the Institute provides have to meet the special needs of this country. The curriculum for the D. P. H. Class is mainly based on the requirements of the British Medical Council, but Col. Stewart, in consultation with the provincial Directors of Public Health and other Public Health Authorities, has so designed the courses of instruction as to include all subjects which the students might be called upon to deal with in the actual discharge of their duties as health officers.

And yet it cannot be said that the present scheme of studies has reached a final and unalterable form, for, with the advance of scientific knowledge and, with changes in the social and economic conditions of the people and also with a possible extension of public health services, a few important additions and alterations may yet be found to be necessary.

In this connection I would like to comment on one important aspect of teaching, namely, field work. I believe there is considerable room for improvement in this branch of instruction. At present the students receive training in the routine and special duties of medical officers of health under the Health Officer, Calcutta Corporation. Besides, they are given a number of demonstrations at places of public health interest in and outside Calcutta. A malaria centre has also been established near Burdwan to provide facilities for field studies in rural malaria. These facilities are, to my mind, inadequate. We must not forget that a very large proportion of India's population lives in villages. The deplorable state of environmental and personal hygiene in our rural areas is proverbial and it is being increasingly recognised that improvement of these areas must be kept in the fore-front of our public health programmes. It is evident therefore that a rural bias must be given to our courses of instruction. The ideal arrangements for giving the requisite training would be, as pointed out in last year's report, to attach the students for some time to really efficient rural health centres. Here the students could easily gain an insight into the problems of rural sanitation and acquaint themselves with rural public health administration in actual process of working. Such centres would, in fact, be analogous to hospitals for medical students. With this object in view Col. Stewart and the representative of the Rockefeller Foundation in India initiated a scheme for a Rural Health Unit in Bengal, and on their advice, the Director of Public Health submitted a scheme to the Local Government. The representative of the Rockefeller Foundation also secured some financial assistance from that institution. On account of financial stringency, however, the Government of Bengal did not find themselves in a position to give administrative approval to the scheme. It is earnestly hoped that, with the return of better times, the Government will see their way to reconsider the matter and eventually to establish a Health Unit near Calcutta. This will add considerably to the usefulness of the Institute and will generally stimulate the public health activities in the province.

Courses held.—There were 50 applicants for the 30 available seats in the D. P. H and D. P. H. and Hy. Class. Three more applications were received some time after the commencement of the session. Only 42 men were found eligible for admission under the University regulations and of these 22 joined the Institute in 1935-36. The class was composed as follows:—

According to the services—	
Government service	2
Local Bodies service	2
Indian States service	1
Railway service	*Nil*
Private practitioners	17
Total	22

Numbers admitted from the various provinces were—

Bengal Presidency	5
Madras Presidency	*Nil*
Bombay Presidency	*Nil*
Punjab	2
United Provinces	10
Bihar and Orissa	1
Central Provinces	*Nil*
Indian States	1
Burma	2
Assam	1
Total	22

In the selection of candidates special consideration was given to the residents of Bengal, but, on the whole, the admissions were fairly distributed over the country except Bombay and Madras. Many of the Bengal candidates failed to pay up the dues within the prescribed time. Lack of keenness on the part of Bengal candidates is easily explained by the fact that the number of qualified graduates far exceeds the present requirements of the province. In view of the existing unemployment among graduates so early in the history of the Institute some sceptics have expressed doubts as to the need for a training centre for D. P. H. on such a large scale. I venture to think that these misgivings are based on a radically erroneous idea. The Institute has been established for satisfying the needs of the country with regard to trained health workers. This need is at present far from being satisfied. Each and every district and all municipalities with 20,000 or more population should be expected to employ at least one medical officer of health. At present about 134 districts and 224 towns of the above description are without qualified public health officers. At a very modest estimate at least 1,500 qualified men are required to supply the minimum requirements of the districts, large and small towns, Indian States, railways, tea gardens, mines, and other industrial centres. Surely one Institute can hardly be expected to meet a demand of this size in a reasonable period of time. It is true that many provincial Governments and local bodies do not at present find themselves in a position to shoulder the financial burden of employing highly paid health officers, but with the introduction of autonomy in the provinces it is hoped that public opinion will demand a higher standard of health administration both in the urban and rural areas, and thus an increasingly large number of qualified workers will be required.

Special course.—Many health workers feel that, on account of lack of contact with academic centres and rapid advance in public health sciences, they require a general revision course to brush up their knowledge. Some others find that the special nature of their duties demands a higher knowledge of certain subjects than is provided for in the ordinary D. P. H. course. To meet these requirements 6 three months' post-graduate courses were drawn up in the following subjects:—Biochemistry, Nutrition, Vital Statistics and Epidemiology, Malariology, Maternity and Child Welfare and a combined course. During this year one student from Burma (Assistant Director of Public Health) took the combined course. An officer was deputed for training in Epidemiology and Vital Statistics for one year as a fellow of the Rockefeller Foundation by the United Provinces Government.

D. Sc.—Arrangements were made for advanced teaching and research with a view to preparing candidates for D. Sc. (Public Health) of the Calcutta University. One student was deputed by Hyderabad State to prepare for D. Sc. in the Department of Epidemiology and Vital Statistics. Another student from Bengal took Biochemistry as his special subject for D. Sc.

Besides these official courses a post-graduate course in tuberculosis was also held in the Institute under the auspices of the King George's Thanks Giving (Anti-Tuberculosis) Fund, full details of which will be found in Dr. Mehta's note attached to the report. This course was attended by 25 medical graduates from all over India and Burma. It may be hoped that this special course which gives an intensive training in clinical, laboratory, and public health aspects of tuberculosis to a selected group of medical men, who are in a position to make use of their training, will go a long way in stimulating public consciousness and providing a personnel which can organise and successfully conduct anti-tuberculosis campaigns in different parts of the country. The course was an unqualified success and this was mainly due to the unbounded energy and enthusiasm displayed by Dr. Ukil, and to his thorough grasp of the various aspects of the tuberculosis problem in India. He loves his work for its own sake and has set an admirable example of selfless work to the junior members of the profession.

Affiliation to the University.—Under Section 7, Chapter XVIII of the Calcutta University Regulations, an Inspection Committee visited the Institute and as a result of their report, the Institute was affiliated to the University of Calcutta for Diploma in Public Health, and for Doctorate in Science (Public Health).

Accommodation.—The general plan of the Institute was explained in last year's report where it was mentioned that, on account of the fact that all the sections of the Institute had not begun to function, a certain amount of laboratory accommodation was available which was taken up by the Leprosy Research and the Kala-azar Enquiry based on the School of Tropical Medicine and the Malaria Section of the Public Health Department. With increased activities of the various departments pressure on the allotted accommodation was felt and part of the quarters occupied by the Assistant Director had to be converted into laboratory accommodation. Further accommodation was also made available by internal re-arrangements, but it would appear that the growing needs of the various departments will soon demand more space than is at present available and it will be increasingly difficult to house outside enquiries for a long time.

Museum.—A properly fitted Museum for the use of the students is an urgent necessity. Necessary space has been allotted, but a museum takes time to be built up. A large number of charts, diagrams, and models were added to the collections this year and a systematic plan of arrangements was prepared. Suitable cases and other fittings are being made and it is hoped to complete at least two sections shortly. In this connection I am glad to acknowledge the guidance and assistance of Dr. Baini Prasad, Director, Zoological Survey of India.

Library.—Like the Museum the library takes time to grow. A nucleus was provided from different sources. To begin with, the School of Tropical Medicine and the library of the Surgeon General to the

Government of Bengal contributed a number of books and periodicals. Before his retirement Major General (now Sir) J. D. Graham, C.B., C.I.E., I.M.S. (RETD.), very kindly made a gift of a number of books to the Institute; a similar gift was also kindly made by Lt.-Col. A. D. Stewart, C.I.E., I.M.S., to both of whom our thanks are due. A number of books and journals were received from the surplus stock of the Central Research Institute, Kasauli. Amongst these collections, the first 15 volumes of " Biometrika " were specially valuable. During the year under report 536 volumes (books 244, journals 117, and reports 175) were added to the library bringing the total number of volumes to 4,661. We received by purchase or otherwise 60 current periodicals. Arrangements have been made with the School of Tropical Medicine to avoid duplication in the purchase of books and journals and between the two libraries we now get almost all important journals and periodicals. Both the libraries are open to the staff and students of the two institutions and thus adequate library facilities are available.

Stipends.—A stipend worth Rs. 50 per month has kindly been offered by the Indian Red Cross Society for a D. M. C. W. student and another scholarship of Rs. 30 for a suitable candidate for the same course has been offered by Dr. Balfour. We are grateful to the donors for these generous gifts. No student, however, joined the D. M. C. W. course in 1935-36.

Research and investigation.—In last year's report Col. Stewart had discussed cholera problems in India and abroad in a general way and its present position. He had mentioned that the Institute was engaged in investigations into some of the important problems, which had so far eluded solution, particularly the rôle of carriers in initiating epidemics. These problems were not only of primary importance to India, but also to the world at large. In these investigations the School of Tropical Medicine and the Central Research Institute at Kasauli are intimately associated. The general plan of work of the associated enquiries was explained in the last report to which a reference may be made. It will suffice here to say that these enquiries continued to work on the lines laid down by the Cholera Advisory Committee. A special meeting of this body was held in Kasauli in September, under the presidency of Col. Taylor, to discuss certain points in connection with the co-ordination of results. On the last day, the progress made by different enquiries was reviewed. The Public Health Commissioner was present at this meeting and, after surveying the whole position, he expressed his satisfaction at the progress made by the associated enquiries.

Cholera, as Col. Stewart has pointed out, has been with us from time immemorial. On many occasions epidemics and even pandemics have originated from certain parts of the country and these have involved other parts of India and have at times extended to as far as Europe and America. The exact boundaries of these epidemic foci and the peculiar features which are responsible for endemicity have never been fully determined. How precisely this infection maintains itself in these areas and how epidemics originate in non-endemic tracts are some of the problems which have so far baffled the sanitarians. As a first step towards the solution of these mysteries it was necessary to delimit, if possible, the endemic and epidemic areas. To begin with, the definition of endemicity presented difficulties. Obviously in a truly

endemic area outbreaks of cholera should occur independently of importation of infection. Many people doubt that such areas exist. Discussion on this point may be postponed to a later part of the report, but for statistical considerations two criteria of endemicity have been taken, namely, (1) low fluctuation in the incidence of cholera, and (2) brevity of the inter-epidemic periods in which infection can be presumed to continue. The standards in each case must necessarily be arbitrary, because our knowledge of the longest period during which persistence of infection could be presumed is far from complete. One point, however, needs special mention, namely, that in order to minimise the risk of pooling experience of heterogeneous areas, the units of observations must be reduced to the smallest possible size. So far the work has been confined to south western districts of Bengal. A summary of the methods employed and the results obtained will be found in the report of the Professor of Vital Statistics and Epidemiology. It will be noticed that, on the basis of the criteria chosen, the really endemic foci are confined to small areas situated mostly along the lower reaches of the Hooghly. The enquiry has now reached a stage when detailed field studies in different types of areas can be usefully undertaken with a view to determining the reasons for the difference in their epidemiological experience.

To investigate the problems concerning the persistence of infection during the inter-epidemic periods, the reasons why infection lies dormant during these periods and the factors concerned with its reactivation, the rôle of carriers in initiating epidemics and a host of other unsolved problems, an intensive field study has been undertaken in a small endemic area. From the bacteriological point of view these problems present special difficulties in cholera, because the *Vibrio cholerae* is liable to great variation and there is no laboratory animal in which the disease can be satisfactorily reproduced. The only way in which we can, at present, judge the virulence of a particular strain of vibrio, is to study the circumstances connecting the organism to a clinical case of cholera. This obviously is a very unsatisfactory position and it, therefore, becomes necessary to devise laboratory tests which would differentiate the virulent or potentially virulent organism from the avirulent strains. A general discussion of the methods employed and the results so far obtained will be found in the report of the Professor of Vital Statistics and Epidemiology. Depending as they do on natural happenings, field studies necessarily make slow progress. A mass of data has been collected and partially analysed, but the stage has not yet been reached when definite pronouncements can be made. However, certain facts seem to emerge from the studies so far made.

It appears that, under relatively simple rural conditions, in an endemic area case to case infection is of frequent occurrence and most of the epidemics originate from previous cases. However, this does not seem to be a complete explanation. Cases occasionally arise in which infection from existing cases can be eliminated. Infection during the inter-epidemic period seems to be maintained for a considerable period in the intestine of man both in the convalescent and healthy carriers. It may also persist for long periods in the tanks. There is probably a free exchange of vibrios between the human intestine and the tanks, but the organisms are not usually maintained in a

virulent form because they fail to initiate epidemics. Two distinct types of cases seem to arise; sporadic cases which not only do not give rise to secondary cases but fail to establish infection among the contacts, and other cases which, under the same circumstances, originate epidemics.

Suggestive evidence has been obtained associating carriers with cases. Preliminary investigations seem to suggest that organisms undergo changes in the intestine of man during the course of convalescence as also in the intestine of carriers. Different types of organisms may be found at the same time amongst the different members of a family. Serological tests so far available are inadequate for distinguishing between virulent and avirulent organisms; nor do they provide satisfactory information regarding their epidemiological studies.

Dr. Linton's studies on the chemical constitution of vibrios have undoubtedly added to our knowledge regarding the characteristics of virulent organisms to a great extent. It has been shown that all the vibrios derived from various sources, which have so far been tested, fall within the frame-work of his 6 chemical groups. Close correspondence between the metabolic activities of a strain and its chemical constitution has been demonstrated. However, the difference between the metabolic activities of group I and group VI vibrios is not sufficiently marked to enable one to differentiate between the two groups with certainty. This relationship greatly simplifies the determination of the chemical constitution of a given strain. Utilising these methods, it has been found that all the vibrios derived from cases or immediate contact of cases belong to groups I, II or VI. Quite a number of persons, who had not been recently in contact with patients, also carried organisms belonging to these groups, but a majority of them excreted vibrios belonging to other chemical groups. The vibrios recovered from the tanks on the other hand did not belong to the groups mentioned above, except in one case in which an organism of group II was recovered from a tank. Tests based on metabolic activities of the organisms also failed to distinguish between the organisms recovered from sporadic or epidemic cases, nor were these tests able to indicate the stage of epidemic during which they were isolated. We thus see that, although the chemical constitution of an organism seems to be closely related to its source of origin and that certain groups are definitely associated with clinical cases, there are some fine shades of difference between actively virulent organisms and those whose infectiousness and virulence have somehow declined. It is now well-known that vibrios are very liable to suffer frequent changes in their serological re-actions, but it is interesting to note that changes in their chemical constitution also frequently occur. This may sometimes happen *in vitro* in the course of subcultures even when one starts with a single cell culture. The changes in the tanks seem to take place rapidly and these are in the direction of a change from virulent to avirulent groups. The variations *in vivo* are of much greater significance and these may occur in either direction. In convalescent carriers one usually notices change from virulent to avirulent forms, but in healthy carriers variation in the reverse direction may occasionally occur. Here we are using the term " virulent " in the chemical sense as explained above.

These tentative conclusions are subject to confirmation, but assuming them to be correct, one might speculate on the probable sequence

of events leading to the development of epidemics in endemic areas. Besides the travelling epidemics which explained most of the outbreaks, it is possible that the infection persists for many months in tanks, but it lies dormant on account of the decline of virulence of the vibrios. It also persists in the intestine of man and, through frequent mutual contamination of tanks and carriers, infection is maintained for many months, if not years. Through some unknown causes the avirulent strains in the human intestine assume virulence and give rise to sporadic cases. In some cases the change in virulence is of the extreme type and vibrios from such cases are highly infectious and are capable of giving rise to epidemics. This is a mere hypothesis, but the evidence so far collected appears to justify its adoption as a working hypothesis.

Reference has already been made to some of the illuminating studies on chemical structure of the vibrios, obtained from different sources, by Dr. Linton. There are, however, certain other points which must be mentioned. Mr. Mitra of this Enquiry has contributed an important paper on the chemical structure of the two proteins found in cholera vibrio. This confirms Dr. Linton's views regarding the separate identity of these two proteins. Their specificity is further confirmed by his serological studies in which he has used these two proteins combined with radicals such as atoxyl, sulphanilic acid, m-amino benzoic acid, etc., as antigens as well as by observations on their absorption spectra. Dr. Linton's studies on the chemical structure of H and O antigens and on the changes which they undergo when the vibrio is heated to destroy the H antigen are of special interest. These and other basic studies of Dr. Linton are of utmost importance in throwing light on the chemical and epidemiological behaviour of the vibrios. A summary of his work is given in the latter part of his report. For detailed information papers published by him on the subject may be consulted.

Epidemic Dropsy.—The epidemiology, especially the ætiology, of Epidemic Dropsy which is a disease peculiar to the eastern part of India is still obscure. The Institute co-operated with the School of Tropical Medicine to carry out investigations on this disease. A number of field studies were conducted, one centre being in Bihar and Orissa, one in a part of Calcutta City and three in different parts of Assam. The most striking fact brought out was the special predilection of the disease for the middle class people. Neither the very poor nor the very rich persons were affected. Again the disease was usually restricted to certain communities in a given place, but the communities escaping infection in one place were sometimes severely involved in another locality. Age distribution was also striking. The results obtained in the field studies failed to incriminate rice as the vehicle of infection. Mustard oil could not be excluded as an ætiological agent. Contact infection could explain some occurrences, but in the absence of our knowledge of the causative organism no positive proof of this means of transmission could be obtained. These studies are in progress and it is hoped that in the course of time the mystery surrounding this disease will be cleared up.

The general programme of research in the Department of Biochemistry was outlined in last year's report where it was stated that research was proceeding along two main lines, *viz.*, (1) basic work,

which comprised of the analysis of the main foodstuffs commonly consumed by the people of this country, and (2) a survey of the dietry of the various groups and communities in India. Investigations along these lines were carried out and, as will be seen from the report of the Professors in charge, definite progress has been made. To these two lines of research a third was subsequently added, namely, a study of the physique of children in relation to the food consumed by them. With regard to the analysis of foods, all the available foodstuffs have been analysed in respect of their calcium and phosphorous contents. A survey of vitamin A and vitamin C has also been completed and the lovers of the mangoe fruit will be glad to know that, in taking the delicious "*langra*" variety, they are supplying themselves abundantly with vitamin C which, as a rule, is deficient in Indian dietry. Similarly, the vast vegetarian population of the country need not worry about vitamin A deficiency provided they include a liberal supply of common 'sags', particularly the 'soya sag'. Recent work has imported great complexity into the problem of vitamins, particularly in those relating to vitamin B, of which four or more types have been recognised. The vitamin B analysis of some foodstuffs was taken up by a few voluntary workers who have made some progress along biological analysis of vitamin B_2, but the investigations have not yet reached the stage when a definite pronouncement can be made.

Dr. Wilson and his co-workers have recently contributed a paper on "The diet survey of certain sections of communities in Calcutta" They have studied the usual diet of twelve middle class Hindu families and three institutions, namely, a Moslem and a Hindu orphanage and a residential Anglo-Indian school. They have also included in their studies a hostel accommodating 16 Bengalee young men each earning, on an average, Rs. 40 a month, and this they have considered fairly representative of upper standard of living of unmarried wage earners with other obligations. They concluded that the food of all the groups investigated was deficient in total and animal fat, in calcium and to a certain extent in phosphorous. They recommended that the best way to meet these defects would be to make a substantial addition of milk and other dairy products to the day's fare and to partially substitute wheat flour for rice. These findings, though based on rather small data, are quite significant especially when it is remembered that the subjects of investigations belonged to comparatively better classes of the population. While much remains to be done in the way of diet surveys one fact stands out clearly, and this cannot be too strongly emphasised, namely, the immediate need of a national milk programme. In England and in other countries milk feeds to school children have yielded encouraging results. In India, where the problem is much more acute on account of the absence of animal food in the dietry of the common people, need for such an institution is all the more pressing. From the practical point of view, however, the nature of the problem in these countries is somewhat different. While in England the chief difficulty arises from the fact that the drinking of milk is not a habit with the people, and to change food habits is not an easy matter, in India this difficulty hardly exists because the people have always looked upon milk as a perfect food and a drink-more-milk campaign will be extremely popular not only with children, but also with adults. The problem here would practically reduce itself to the production and

distribution of this important article of diet, and there is little doubt that an organised effort to find ways and means for greatly increasing the production of milk and improving its quality will result in raising the standard of nutrition of the masses.

Diet surveys are not complete unless they are related to the nutritional conditions of the people and unless they include a survey of the diseases due to malnutrition. A simple index of nutritional condition has been suggested in the form A. C. H. index. Dr. Mitra examined 500 children and found that the index was distinctly higher in the institutions in which the parents bore the expenses of their wards as compared with the orphanages which depended on charity. Associated enquiries on similar lines have been instituted in Madras and Bombay, and it is hoped that when sufficient data have been collected, standards of the index suitable for the Indian conditions will be worked out and will be made available to workers in different parts of the country, for the purpose of comparison and for determining the nutritional condition of different groups of population.

Absorption of carotene under various conditions was studied by Mr. Majumdar and Mr. Gupta, and interesting results were obtained which may find important practical application. Dr. Ahmed continued his work on the excretion of scorbutic acid in urine and his observation that the excretion increased with the consumption of salted meat is interesting and suggests a possible explanation of the frequent occurrence of scurvy on board the ships in the old days. However, the identity of the reducing substances in the urine with scorbutic acid still remains unsettled and further work in this connection is being carried out. An interesting investigation into the ætiology of cataract in man was also initiated during the year under report, but sufficient progress has not yet been made to warrant conclusions.

The Biochemical Department has been of assistance to various other research units both in this institution and the School of Tropical Medicine. Besides, a large number of enquiries on nutritional subjects were received from various bodies which augurs well as a step towards the application of knowledge gained through research work for the good of the people in general.

The ætiology of black-water fever is still shrouded in mystery, and its patchy distribution in malarial tracts has baffled epidemiologists. Dr. Krishnan's previous studies on the subject led him to search for an explanation on biochemical lines. As a result of his investigations he has been able to put forward a tentative theory of the mechanism of hæmolysis in black-water fever which, if confirmed, will suggest a rational method of treatment of this fatal disease. He believes that sudden hæmolysis in black-water fever is due to disorders of metabolism which, on the one hand, results in the production of hæmolytic substances in the form of unsaturated fatty acids and lecithin and, on the other hand, in a lowering of protective free cholestrol. His main contribution is the observation that while the total cholestrol contents of blood may show no change, there is a distinct fall in the free cholestrol content of the blood. Blood glucose is also diminished due to defective metabolism of carbohydrates which results in the formation of fats and fatty acids, some of which deviate cholestrol and form astrocholestrol. He is now proceeding with a rational treatment

based on the above theory and has obtained some encouraging results in monkey malaria.

Our knowledge of the incidence of syphilis in the various groups of the population of India is extremely scanty. Such knowledge is essential for awakening public consciousness and for planning anti-venereal campaigns. Dr. Krishnan made a beginning by investigating three groups of population. He found a striking difference in the incidence of the disease in the military and the jail populations, the percentages being 6 and 22 respectively. He is extending his investigations to other groups of people with a view to obtaining fairly accurate estimate of the distribution of syphilitic infection in different communities in the City of Calcutta.

Field studies in malaria were also conducted by the Malaria Department mainly with the object of discovering the causes of endemicity in certain areas. Two field investigation centres were established, one in the endemic and the other in the epidemic area. While no conclusive explanation of endemicity has yet been found, certain suggestive factors have been noticed in connection with mosquito breeding. Permanent accumulations of water which were found in the non-endemic areas in larger numbers did not favour breeding to the same extent as the temporary ones did. Again, jute steeping which was extensively practised in the epidemic but not in the endemic areas, was also definitely inhibitory to mosquito breeding.

Dr. Krishnan and his co-workers have paid special attention to the practical (though controversial) question of the value of fish as an anti-larval measure. Planned observations on mosquito breeding were made under varying conditions, and it was found that the fry of the carp and the *Panchus panchus* were the natural enemies of larvae, but their efficiency was greatly reduced in the presence of the parasitic vegetation commonly met with in village tanks in this province. Too much dependence on the fish as an anti-larval agent is therefore not justifiable unless a regular service for clearing tanks of rank vegetation can be arranged.

Other interesting observations made by this Department will be found in Dr. Krishnan's report. These chiefly relate to the biochemical studies in malaria, kala-azar, and other diseases.

Increasing industrialisation in India has, as in other countries, brought to the fore a number of problems in connection with the health of the workers. Dr. Orkney, Professor of Maternity and Child Welfare, interested herself in the study of problems relating to the women and infants in industrial communities in Calcutta. Enough data could not, however, be collected and no pronouncement can therefore be made. It is hoped that these important investigations will be continued by her successor and that useful results will be obtained when the staff of this department has been strengthened.

Maternal mortality is one of the most urgent public health problems in this country. There is much unnecessary waste of life which can be prevented. The life of the lying-in mother is not as safe as it can be, and as it should be in a civilised country. In fact this problem has not yet received the attention of the research workers to the desired extent. It is proposed to enquire into the chief causes of

deaths associated with childbirth by a detailed study of all such deaths occurring in Calcutta.

Dr. Ukil has continued to work on a number of problems on tuberculosis with the help of the grants from the Indian Research Fund Association. His contribution on the incidence of the disease amongst the home contacts, specially the children, in relation to the environmental conditions in Calcutta has added a great deal to our knowledge of the epidemiology of the disease. In the course of his bacteriological studies on 143 autopsies he was able to isolate 60 strains all of which were found to be of the human type. This is of very great interest as it shows that man is the reservoir of infection here. This conclusion is further confirmed by the fact that all the 73 strains isolated from pulmonary and extra-pulmonary patients were of the human type. He also investigated the portal of entry by examining various groups of glands. His immunological studies are of special interest. He has employed two methods in these investigations. In the first place he has tried to correlate the clinical and skiagraphical records as also the environmental conditions with respect to exposure to infection with the histopathological changes of the lungs after death. Secondly, he has conducted experiments on guinea-pigs to study the influence of the ultra-violet rays in sun light on the pathological processes and mortality amongst artificially infected animals. These studies will advance our knowledge of the epidemiology of tuberculosis under local conditions and will help us in designing anti-tuberculosis measures on a rational basis. On the bacteriological side, Dr. Ukil's studies are also of interest. By making a comprehensive study of the various methods of laboratory diagnosis, he has been able to show that the culture method by a special technique which is simpler, cheaper, and quicker than the animal inoculation method is at the same time more reliable. A combination of the two methods, however, increases the positive finding considerably.

It is now my pleasant duty to acknowledge with thanks the help and assistance which I have ungrudgingly received from my colleagues and fellow research workers. I owe a special debt of gratitude to Bt.-Col. Chopra, C.I.E., K.H.P., I.M.S., Director of the School of Tropical Medicine, who has always kindly given me the benefit of his experience whenever I had the occasion to consult him. He has also shown a very pleasant spirit of co-operation in matters relating to the two institutions. We are grateful to the Governing Body of the Indian Research Fund Association for giving grants to various enquiries based on this Institute. Without such grants it would have been impossible to undertake research on many problems specially when we have no endowment fund like the School of Tropical Medicine. Our thanks are also due to Dr. W. P. Jacocks, local representative of the Rockefeller Foundation, and to the members of the International Health Board, New York, who very kindly granted a fellowship to Dr. D. L. Shrivastava, one of the research workers in this Institute.

REPORT OF THE PROFESSOR OF VITAL STATISTICS AND EPIDEMIOLOGY FOR THE YEAR 1935.

(Dr. K. C. K. E. Raja, l.r.c.p. & s., d.p.h., d.t.m. & h.)

The work of the Department falls under two heads, namely, teaching and research.

Teaching.—In last year's report it was pointed out by Dr. R. B. Lal that the twenty lectures laid down by the University were insufficient and that the lectures, demonstrations, practical work and tutorial classes, according to a programme which was drawn up, took over a hundred hours to complete. The Institute has been established for the purpose of providing a public health course which is specially suited to Indian conditions and Lt.-Col. A. D. Stewart pointed out in last year's report that, in view of the facilities available at the Hygiene Institute and the School of Tropical Medicine, the Diploma in Public Health acquired by the students in Calcutta should be considered preferable to similar qualifications obtained abroad. Under the circumstances, it is essential to keep our standard high. The course in Epidemiology and Vital Statistics, as at present conducted in the Institute, has been drawn up with this end in view and is considered the minimum necessary for equipping the student for his public health career. I therefore think that a revision of the University curriculum is necessary.

In addition to the teaching of D. P. H. students special classes have now been opened for (1) a three months' refresher course in all subjects for Medical Officers of Health in active exercise of their profession, (2) special courses of three months' or longer duration in any of the different sections of the Institute. During the last quarter of the year we had an Assistant Director of Public Health of Burma, Dr. S. H. Aung, for the refresher course and we have still with us a member of the Public Health Department of the United Provinces, Dr. P. N. Chatterjee, who has been deputed on a Rockefeller Foundation fellowship for a year's special course in Vital Statistics and Epidemiology. For Dr. Chatterjee a more detailed programme of study has been provided than for the D. P. H. students. A course in Mathematics has been included as, without it, the medical man entering on the study of Statistics, does not acquire a sufficient knowledge of the subject to use it with confidence. Mr. Satya Swaroop, the Mathematical Assistant of this Department, is giving the course in Mathematics while I am doing the course in Statistics.

Researches—Cholera Research.—As has been pointed out in last year's report there are two sections, (1) a statistical enquiry, at the headquarters, into the incidence of cholera in Bengal and (2) a field enquiry in a group of sixteen villages in the Diamond Harbour *thana* of 24-perganas district of Bengal.

Statistical Enquiry.—There are two purposes in view for the present study. One is to secure a description, in numerical terms, of the special epidemiological features of the locality studied; this must necessarily precede any investigation into their causes. The other is

to devise a satisfactory method of forecast, which makes use of the information afforded by the epidemiological study. With respect to both these objects, the securing of homogeneity of cholera experience in the area studied is of supreme importance.

A preliminary statistical investigation of the figures for cholera mortality in Bengal during 1901-30 having revealed heterogeneity among the districts as regards mean and seasonal incidence of the disease, it was decided to work with the figures of individual *thanas*, which are the smallest areas for which figures are available. The incidence of cholera exhibits a seasonal variation as well as a variation from year to year. Hence the first step was to analyse the total variability in a *thana* for the period of our study, 1901-1932, into three parts:—(1) seasonal or between months, (2) cyclical or between years, and (3) residual variability. The first two constitute quantitative expressions of the effect of factors which come into operation during special seasons of the year or during particular years respectively. The third portion of variability is the result of all other causes producing fluctuation in cholera mortality. In view of the heavy arithmetical calculations involved, the work thus far carried out has been confined to the *thanas* of a group of nine districts in the south and west of Bengal, namely, (1) Birbhum, (2) Burdwan, (3) Bankura, (4) Midnapore, (5) Hoogly, (6) Howrah, (7) 24-Parganas, (8) Khulna and (9) Backergunj.

The three types of variance mentioned above direct our attention to specific epidemiological characteristics of the locality concerned. Thus, a high seasonal variability may point to factors, such as climatic variations or the occurrence of festivals or other causes producing large scale movements of population (for instance, agricultural labour) as being responsible for the recurrence of cholera at particular seasons year after year. A large yearly variance may, similarly, suggest that the area concerned is of the epidemic or endemic-epidemic type, so that years of high cholera incidence are followed by periods of comparative quiescence. The centres have been combined on the basis of similarity of seasonal or yearly variation and the way has now been prepared for the investigation of the causes underlying these fluctuations.

Endemicity and epidemicity.—Apart from the indication that the values for seasonal and yearly variances may give, regarding the endemicity and epidemicity of cholera in a locality, we may discuss the question from the standpoint of the distribution of cholera incidence in relation to time as a variable. Two arbitrary standards were adopted:—

(1) In an endemic area the total number of months with absence of cholera deaths should not exceed 30 during the 32 years, which is the period of our investigation.

(2) A break of five months or more in cholera incidence has been taken as being indicative of the centre not being an endemic area.

These standards may be judged as too high or too low by different persons, but the necessity for some such standards will hardly be disputed.

On the basis of these standards the centres in the districts of Khulna, 24-Parganas, Midnapore, Howrah, Hoogly, Bankura, Burdwan, and Birbhum were examined and it was found that the centres, which were

endemic by satisfying both criteria, were only a few and were confined to the districts of Midnapore, Howrah and 24-Parganas—

Midnapore District.—(1) Egra and Contai, (2) Maisadal, (3) Nandigram, (4) Panskura, (5) Tamluk and Moyna.

Howrah District.—The whole of the district.

24-Parganas.—Magrahat.

The following centres are classified as endemic with a query, as they satisfy the second of these conditions but do not depart from the first to any great extent:—

Midnapore District.—Bhagwanpore and Khejri.

Hoogly District.—Khanakul.

24-Parganas.—(1) Bishnupur, (2) Baruipur *cum* Pratapnagar and (3) Kulpi, Kagdwip group.

It may be seen that these endemic centres tend to lie on either side of the lower portion of the Hoogly river.

Forecast.—Attempts are being made to develop a satisfactory method of forecast. Bundeson and Hedrich have elaborated a method of forecasting epidemics by working out monthly or weekly expectancies based on median incidence of the disease for a few preceding years and making use of these expectancies for watching the trend of current events. The actual occurrences, month by month or week by week, are made percentages of the respective expectancies and are called epidemic indices. If the curve of epidemic indices steadily rises so as to approach the 100 per cent. level, then the indication is that an epidemic is due. When it rises above this level the epidemic is definitely in progress. It is proposed to improve this method. For any area of homogenous cholera experience two or three centres are chosen and by periodogram analysis, the epidemic cycle is determined. This additional knowledge can be made use of to correct the expectancies based on median values for the centres concerned. These corrected expectancies can be utilised for calculating epidemic indices for the respective centres. The selection of two or three centres in a homogenous area and the forecasting of cholera incidence in these centres will give a fair indication of the experience that is likely to occur over the whole area.

Field Enquiry.—The organisation and conduct of the field enquiry were explained in the last report. The problem for investigation is "How is cholera transmitted?" and with it is involved the question of the maintenance of infection during the non-epidemic season. The results of the year's work have been briefly stated below:—

I. *Case to case infection.*—The chain of cases is not continuous and the hypothesis of case to case infection will not suffice to explain the maintenance of infection during the non-epidemic season.

II. *The carrier as a reservoir of infection.*—No definite conclusion can yet be drawn regarding the length of period of the carrier state. The difficulty is to exclude the possibility of re-infection under the conditions prevalent in the villages. However, as the re-examinations of the carriers showed a significantly higher rate of positives than in the case of the general population, this result must have been due to relapses in the case of some carriers. Moreover, a log curve fitted to the data demonstrated a progressive diminution of the number of carriers

with lapse of time, which is unlikely if there was continuous chance of re-infection. The period of the carrier state can, however, be definitely settled only by an experiment under controlled conditions as in a jail or a hospital. If the term relapse is used " in the sense of intermittent excretion of vibrios whether due to re-infection or as continuous but undetected carrier state," the information available is briefly given below:—

Total number of carriers followed	238
Number relapsed	77 or 32·3 p.c.
Average period of the carrier state	29 days.
Number of carriers followed during the epidemic period (Epidemic period denotes the time from the occurrence of the first case in the village to seven days after the last case)	40
Number relapsed	16 or 40 p.c.
Average period of the carrier state	35 days.
Number of carriers followed during the non-epidemic period	198
Number relapsed	61 or 30·9 p.c.
Average period of the carrier state	25·8 p.c.

Some indication of the frequency of relapses may be obtained from these figures:—

Number of relapses.	Number of carriers.	Number of relapses.	Number of carriers.
1	44	4	5
2	17	5	2
3	9		

The average interval between relapses was 16 days and the maximum was 42 days.

The present study, therefore, suggests that healthy persons may continue as carriers for fairly long periods and that relapses may be sufficiently frequent to establish an association between the carrier state and the prevalence of cholera in the community.

III. *The carrier as a transmitter of infection.*—The three criteria necessary for incriminating a carrier as the transmitter of infection are:—

(1) the carrier state should have existed prior to the occurrence of the case. Further, the interval between the demonstration of the carrier state and the attack of cholera should be as short as possible;

(2) the carrier's relations with the patient should have been so intimate as to justify the assumption of transmission of infection;

(3) all other possible sources of infection should be excluded.

In regard to the first criterion, examinations of the population under observation at very frequent intervals, say two weeks or less, are essential. But the available resources have rendered it impossible to carry out a round of examinations within a period short of three months. As regards the second criterion, sufficient data have been collected. The most difficult one to satisfy is the third point. It has been assumed

that " if cases did arise in close association with carriers at a time when possibility of infection from a case could be definitely excluded, the ultimate source of infection is the carrier, whether he infects the victim directly or through the mediation of flies or tanks ". The possibility of introduction of infection by imported articles of food should also be eliminated. Three cases, where these conditions were satisfied and which in consequence might be attributed to carriers, are cited below:—

(1) The patient was a young woman. She had an attack of diarrhœa on the 25th April 1935. Agglutinating vibrios were isolated from her stool, and on the same day non-agglutinable vibrios were recovered from the stools of the woman who cooked food for the family. Possibility of contact of the patient with a previous case or any other source of infection could be definitely excluded though cholera cases existed in another *para* of the village.

(2) An old widow was attacked on the 24th April 1935. The attack was severe and proved fatal next day. Her stools were not examined. The carrier was the grand-daughter of the patient from whose stools non-agglutinable vibrios were isolated on the 1st April 1935. Her father lived in a separate house but she being fond of the grand-mother used to spend the greater part of the day and sometimes the night with her. No other source of infection could be traced and there had been no case in the village for three weeks previously.

(3) A young boy was attacked on the 29th June 1935. The patient was himself found positive (non-agglutinable vibrios) on the 17th June. There was no case in the village for a year previously and the patient had not been in contact with any case of cholera. The carrier in the family was a young girl whose stools were found positive (non-agglutinable vibrios) on the 18th June. A visitor had come to the house on the day previous to the attack and had left on the 29th. He is reported to have brought no food with him. His stools were not examined. In this case there is also the possibility that the patient, who was a carrier, had a clinical relapse.

Epidemic Dropsy.—The organisation is practically on the same lines as that for the Cholera Carrier Enquiry, the clinical and bacteriological aspects of this enquiry being helped by the respective departments of the Calcutta School of Tropical Medicine. Enquiries were conducted during the year in five different centres, (1) one centre in Bihar and Orissa, (2) another in Calcutta City and (3) three centres in Assam.

Epidemic dropsy has been prevalent in Bengal and Assam for about fifty years and, within recent years, a considerable amount of work has been done in the School of Tropical Medicine. The principal theories regarding the ætiology of the disease are:—

(1) the rice theory as propounded by Acton and Chopra,

(2) that it is an infection conveyed from patient to patient by personal contact,

(3) that some deleterious substance is introduced into the food through the vehicle of mustard oil.

The present investigations were conducted with an open mind to test the validity of these theories as also to narrow down the issue, in the hope that the laboratory study of the ætiological factor or factors might be rendered easier. The information afforded by the present study regarding the epidemiological characteristics and the ætiology of the disease is briefly set out below. The figures given represent the combined data of the five centres, except in table IV.

1. *Age.*—Breastfed infants escaped altogether and the incidence of the disease among children under 5 years was slight. Above this age the rate rose rapidly and continued high till the extreme end of life recorded a slight decline in incidence.

TABLE I.

Age distribution of the rate of incidence of epidemic dropsy.

Age groups .	0—	½—	1—	3—	5—	15—	25—	35—	45—	55—	65—
Percentage incidence.	0·0	0·0	0·7	3·4	27·6	25·2	24·1	23·8	24·8	23·3	21·6

2. *Sex.*—The distribution of cases between the two sexes showed no appreciable difference.

TABLE II.

	Percentage incidence.
Males	2·3
Females	2·1
Total	2·1

3. *Economic Status.*—There was a definite tendency for the cases to be associated with certain economic classes of the population in the affected areas.

TABLE III.

Incidence of epidemic dropsy according to the economic status of the families.

Economic status.	Affected.	Unaffected.	Total.	Percentage affected.
Very poor	0	69	69	0·0
Poor	9	653	662	1·4
Lower middle	30	500	530	5·7
Middle	21	117	138	15·2
Upper middle	2	49	51	3·9
Rich	0	11	11	0·0

The middle class seems to have been hit hardest. The rate of incidence rises with an improvement of the economic condition, though the two uppermost classes show a decline. These two classes contain, it should be remembered, smaller numbers of individuals in comparison with the three immediately preceding classes.

4. *Religion.*—In the five centres investigated the bulk of the population consisted of Hindus and Mohammadans. The distribution of cases between these two communities presents some interesting facts.

TABLE IV.

Incidence of cases of epidemic dropsy among Hindus and Mohammadans.

	Hindus.		Mohammadans.	
	Population.	Percentage affected.	Population.	Percentage affected.
1. Gourangdih, Manbhum District (Bihar and Orissa).	965	13·68	89	51·59
2. Calcutta (a small area in south Calcutta).	1,934	9·72	54	*Nil.*
3. Patharkandi, Sylhet District (Assam).	302	10·93	174	10·92
4. Karimgunj, Sylhet District (Assam)	4,022	2·21	1,298	*Nil.*
5. Sylhet Town (Assam) . . .	11,453*	0·95*	9,982	1·02

* The figures given relate to non-Mohammadans as a group because the figures for the census population could be obtained only as classified into these two categories.

It may be seen that the distribution of case incidence in the two communities, Hindus and Mohammadans, seems to differ in the various centres, though they were living side by side. Thus, there was high incidence in Gourangdih among Mohammadans while in Karimgunj they escaped altogether, though the numerical strength of the community was not inconsiderable (1,298).

The information regarding the ætiology of the disease is summarised below:—

1. *Rice theory.*—The theory as propounded by Acton and Chopra states that certain varieties of rice, when stored under specific conditions of temperature and humidity, become infected with organisms of the *C. vulgatus* group. These organisms produce a water soluble toxin which causes epidemic dropsy. Parboiling of rice results in the killing of the enzyme while over-polishing, as in the case of milling, causes damage to the grain and hence these processes help the invasion of rice by the organisms. The result of such invasion is said to be the development of opacity within the grain. The data collected during the present investigations fail to support this rice theory. If the production of a water-soluble toxin was responsible for the disease, the incidence should be the least among those sections of the community, whose practice it is to throw away the water in which the rice is boiled.

This is the custom with all classes except the two classes of lowest economic status, namely, very poor and poor, who partake of the rice-water as well. The disease, on the other hand, showed the lowest incidence among these two classes and, as we have seen already, the economically higher classes, who throw away the water, were effected to a much greater extent. As regards opacity of the grain, the suggestion that bacterial invasion is the cause of it is open to doubt. Rice obtained soon after harvesting has shown, after husking, a considerable proportion of opaque grains while Dr. Lal quotes the opinion of Copeland, an authority on rice, that " for reasons not well-understood wholly chalky kernels.....sometimes occur in crops of otherwise fine rice ".

2. *Contact infection.*—The nature of the causal agent, the portals of entry and discharge and the modes of transmission of infection have not been explained by the upholders of this theory. Further, in examining the data collected, there is the complication that, in the case of persons developing the disease after the first case in a family, the introduction of some deleterious substance through a common food supply may be the determining factor for disease and not contact infection. While there is evidence that, in some of the centres of investigation, " the first few cases were either imported or developed within a week or so amongst those in close contact with early cases ", there is equally a volume of evidence from all the centres that the lower classes of people, like the Bowries, who worked in the affected families and must, therefore, have had abundant chances of contact, escaped almost without exception.

3. *The mustard oil theory.*—Here again the nature of the deleterious substance has not, at any time, been indicated. The use of mustard oil both as food and for bath is universal among the general population of the centres of investigation. Hence, special interest attaches to the data collected by the enquiry in a part of South Calcutta, where the population consists of Bengalees as well as of persons from other parts of India, many of whom do not generally use mustard oil while others have contracted the habit after migrating to Calcutta.

TABLE V.

Distribution of cases of epidemic dropsy in South Calcutta in relation to the use of mustard oil in food.

	Cases.		Population.		Percentage affected.	
	Using mustard oil.	Not using mustard oil.	Using mustard oil.	Not using mustard oil.	Using mustard oil.	Not using mustard oil.
Bengalees . . .	160	0	968	0	16·23	..
Non-Bengalees . .	25	0	608	298	4·11	0·00

This table shows that no cases occurred among those who did not use mustard oil in food. This might be taken as being suggestive

that the use of mustard oil is associated with the incidence of the disease. At the same time, however, if its use is the causative factor, then a group of 608 non-Bengalees, whose habits were similar in this respect to the Bengalees, should not have shown a significantly smaller rate of incidence than the Bengalee Community. The difference in the incidence rates given above is significant. Under the circumstances, it cannot be taken that the case for mustard oil has been proved.

Dr. Lal is in charge of the cholera and epidemic dropsy enquiries and, for detailed information regarding these researches, reference may be made to his reports in the Annual Report of the Scientific Advisory Board of the Indian Research Fund Association for 1935-36.

Help rendered to outside persons.—This Department has been in existence for only about two years and, during this period, there has been a growing demand for help in the interpretation of their data by research workers of the School of Tropical Medicine, Calcutta, and of this Institute, as also from a few persons outside. Help was also rendered to the Public Health Commissioner with the Government of India on two or three occasions.

Staff.—Dr. Lal was in charge of the Department till 13th September 1935 when, consequent on Lt.-Col. A. D. Stewart's proceeding on leave preparatory to retirement, he was appointed to officiate as Director and I was called upon to officiate as Professor in Dr. Lal's place.

Two new posts, a Mathematical Assistant and a Tabulating Clerk, were sanctioned during the year and Messrs. Satya Swaroop and B. K. Sen, who had already been working in the Department in the cholera carrier enquiry, were appointed to these two posts. For the cholera enquiry Mr. K. C. Basak was appointed in Mr. Swaroop's place and Mr. H. C. Chakravarty took Mr. Sen's place.

Acknowledgments.—I must acknowledge the help and guidance received from Lt.-Col. Stewart while he was here as well as from Dr. Lal. All the members of the staff worked loyally and my thanks are due to them. When all have worked well it is difficult to pick out particular names for special notice. However, Mr. A. P. Das-Gupta who, by his diligence and conscientious work, helped towards the smooth running of the Department and Mr. Satya Swaroop who, by his ungrudging acceptance of all types of work and by his untiring industry, always gave of his best, deserved that their services should be specially commended.

REPORT OF THE PROFESSOR OF BIOCHEMISTRY AND NUTRITION.

(Dr. H. Ellis C. Wilson, m.b., ch.b., d.sc.)

The general work of the department of Biochemistry and Nutrition in the past year can be divided into two main lines:—(1) an investigation into the food and nutrition of the community, (2) the prosecution of special problems. The first line of research has been organised under three main headings, namely:—(*a*) food analysis, (*b*) diet survey, (*c*) nutritional (physique) survey of children of Calcutta.

Food Analysis.—This investigation, which was initiated over a year ago, is still in progress. A survey of the calcium and phosphorous contents of all the readily available foodstuffs has been completed. The vitamin A, carotene and vitamin C surveys have also been finished and certain foods merit special attention on account of their high content in these factors and as a means of devising cheap and adequate diets. As regards carotene, all the 'sags' (spinach types) were found to be exceptionally rich in this constituent, the figures ranging from 6 mg. to 11 mg. ('soya sag') per 100 grams. With respect to vitamin C, the most important fruit was found by Dr. Ahmad to be a certain variety of mango (Langra variety obtained from Benares). A figure of over 300 mg. per cent. was obtained in the middle of the season. This is the highest recorded, exceeding that of the Hungarian 'paprika'. The average figure for mangoes, although high, is, however, considerably below the above-mentioned maximum.

Biological assay of vitamins.—This assay which is being carried out by Messrs. Ray and Guha is not yet complete. The process is tedious although it is hoped to have the figures for most of the local Bengal foods available by the end of the year. It was anticipated that a start could be made with the vitamins of the B_2 (flavine) and B_6 group but owing to the amount of work involved with the B_1 analysis this investigation has been somewhat delayed. A grant for extra assistance for this work has been requested from the Indian Research Fund Association which, if granted, will enable the department to carry out this analysis early next year.

Diet Survey.—This survey of families and institutions in Calcutta can now be analysed and criticised in regard to the major foodstuffs and minerals. A preliminary paper of the data is being prepared for publication. A criticism of the diets as regards vitamins is not possible until the analysis and assay of these constituents is complete. The data obtained so far indicate that, among the middle class families, the diet is reasonably well balanced. The fat, protein, and calcium tend to be low but this is by no means always the case. The proportion of calories derived from dairy products is sometimes as high as 29 per cent. while the percentage of the food budget spent on fruit is often all that could be desired. The popular sweetmeat 'sandesh' (casein, fresh milk and sugar) has in many cases considerably improved an otherwise mediocre diet. The diet, however, of three institutions, a Moslem and Hindu orphanage and an Anglo-Indian school, presented

rather a different picture. The protein derived from animal sources was about 10 to 29·8 g. per man value per diem while the fat intake was under 50 g. per man value per diem. The calcium intake per head varied from as low as 0·25 to 0·49 g., figures which do not compare favourably with Sherman's optimum of about 1 g. per diem for the growing child. The percentage of calories derived from dairy products was either nil or negligible in all cases. The average cost of the feeding ranged from Rs. 3 to Rs. 5 per head per month.

A. C. H. (arm, chest hip) index of nutrition.—The investigation of the physique of samples of the school children of Calcutta was initiated by this department during the past year. This index which has been recently worked out in America is intended to select children who are below an arbitrarily selected standard and should hence be subjected to medical examination. The heights and weights have also been included in the survey and a note as to the presence of xeropthalmia or phrynoderma (toad skin) is also being made. The data obtained by Dr. Mitra on some 500 children are encouraging. Accepting an arbitrary standard he has found that, in two fee-paying day schools of the Calcutta middle class, the number falling below this figure is about 12 to 20 per cent. while in the Moslem orphanage whose diet is definitely poor, the corresponding figure is 50 per cent.

I have succeeded in getting a worker in Madras and another in the Bombay Baby and Health Week Association to take up a similar survey in their respective areas. It should be emphasised that, although it is a common belief that undernutrition and its effects are widespread in India, the condition is diffuse and ill-defined and, unlike the major diseases, it lacks a distinguishing feature. No real investigation of the subject can be focussed on any one point until some difinite quantitative and qualitative information is available. It is my opinion that an advance can be made only by the prosecution of some such scheme as is outlined above in association with careful clinical observations and correlated with local social and hygienic conditions.

Epidemic Dropsy.—In co-operation with the School of Tropical Medicine some clinical and biochemical work has been carried out on this condition. The blood calcium and phosphorus were estimated in a series of cases and found to be normal contrary to the findings in East Africa where a decrease in the blood calcium was observed. Unfortunately the cases examined in Calcutta had been suffering from the disease for at least two weeks. Clinical observation showed, however, that there was a tendency to a recurrence of the œdema (calf measurement) on putting them on to healthy (as consumed by the other patients in the hospital) rice. It is possible that rice may exacerbate some of the symptoms and yet not be the exciting cause of the disease. An investigation of the salt and water excretion of these patients showed no abnormality. The ingestion of an extra 15 g. of salt over and above that taken with the food was not followed by either a salt or water retention or an increase of the œdema.

Absorption of carotene.—Under Dr. Ahmad's direction Mr. Mazumdar, a voluntary worker, has been investigating the absorption of carotene under different conditions in rats. He has found that carotene dissolved in oil is better absorbed than when suspended in a colloidal form in water. It is also somewhat better absorbed in colloidal

suspension when bile or meat is added to the diet. The maximum absorption is obtained, as might be anticipated, when the carotene is fed in a natural form such as mango. Mr. Gupta has been investigating the absorption of carotene on himself on different types of diet. The results obtained so far indicate that it is well absorbed although, even on a carotene free diet, there may be an appreciable excretion of this substance by the bowel (possibly the less active alpha form).

Metabolism of ascorbic acid.—Dr. Ahmad has been carrying out some observations on the excretion of reducing substances (vitamin C) on the human subject under different conditions. He found the average excretion to be about 24 mg. per diem. Increasing the intake of ascorbic acid (as fruit) over a period of a week did not materially increase the urinary excretion of this substance. An increase in the meat intake, however, caused two to threefold rise in the output of urine, which fell when the meat was discontinued. It is suggested that the consumption of large quantities of salted meat by the crews of ships in the past may have contributed to the onset of scurvy. The question of the identity of these reducing substances in the urine and ascorbic acid remains unsettled. The feeding of the urine to guinea-pigs on a scorbutic diet failed to prevent them from loss of weight and death. The question of the toxæmic effect of urine had, however, to be considered. On the other hand the reaction of the substance in the urine to heat and lead acetate showed it to have similar properties to ascorbic acid artificially added to urine and similarly treated. A paper is at present in press on this subject.

Experiments on cataract.—With the help of Mr. Ray experiments have been initiated on the ætiology of cataract which is so prevalent in the Punjab and thought to be of a nutritional nature.

Oxidation reduction potential of cholera vibrios.—At the request of Dr. Linton I am preparing an apparatus to measure the oxidation reduction potential of cholera cultures, with a view to finding out whether vibrio types, chemically distinct, show a corresponding difference in their oxidation reduction potential.

During the past year the department has been consulted by various bodies and institutions as to food values, diets for children, animal fodder, etc. There appears to be an increasing appreciation of the importance of expert advice on the feeding of children not only on account of health reasons but also that the best use may be made, in most cases, of a limited food budget.

On the recommendation of the Governing Body of the Indian Research Fund Association I went to Coonoor to discuss with Dr. W. R. Aykroyd, Director, Nutrition Research, Indian Research Fund Association, a policy which should avoid duplication of work and help to co-operate nutritional research in India. The complete field of nutrition, both laboratory and field work, was discussed and a close co-operation is being kept up by the two centres in regard to nutritional investigations.

During the past year the usual course of lectures to the D. P. H. class was given and in addition one public health administrator spent a week in the laboratory as part of a refresher course in public health in this Institute. During the past year six papers were published from the department on the various subjects under research.

REPORT OF THE PROFESSOR OF MALARIOLOGY AND RURAL HYGIENE.

(Dr. K. V. Krishnan, M.B., B.S., M.R.C.P., D.B., D.Sc.)

Staff.—In my last report I pointed out the necessity for additional staff for the department. This year the required extra staff was sanctioned partly by the Indian Research Fund Association and partly by the Government of India. In April, the Association sanctioned two research units, one consisting of Mr. N. G. Pai, M.A., biochemist, S. Diengdoh, laboratory assistant, and a peon, for helping in an investigation into the ætiology and treatment of Blackwater fever, and the other unit consisting of Dr. B. K. Das, L.M.P., S. P. Mazumdar, laboratory assistant, and a peon, for assistance in the conduct of certain field experiments on malaria. In September the Government of India also sanctioned permanent additional staff consisting of Dr. P. N. Bose, M.B., D.T.M., D.P.H., J. C. Biswas, field-assistant, and a peon for research work on Venereal Diseases and Tuberculosis.

Teaching.—In addition to the usual lectures on Malariology, Tuberculosis, Venereal Diseases and other communicable diseases to the students of the D. P. H. and D. P. H. and Hygiene classes the following special lectures were also given:—(1) A course of lectures on the Bacteriological and Public Health aspects of Tuberculosis to the post-graduate students specialising in Tuberculosis under the auspices of the King George Thanksgiving (Anti-tuberculosis) Fund; (2) A course of special lectures on Malaria, Tuberculosis and Venereal diseases to Dr. San Hla Aung, M.B., Ch.B., D.P.H., Assistant Director of Public Health, Burma, who took a special course; (3) Lectures on Malaria and Blackwater fever to the staff and students of the Ronaldshay Medical School, Burdwan, at the request of the Surgeon General, Bengal, and under the auspices of the Maharajadhiraja of Burdwan Memorial Lecture Fund.

Laboratory Research: Mechanism of hæmolysis in malarial hæmoglobinuria.—During the year, the mechanism of hæmolysis in malarial hæmoglobinuria of monkeys was investigated. Our previous experimental work had established that susceptibility was an important factor in its causation (Krishnan, Smith and Lal, 1933). Our cytological studies had shown that the condition was associated with a failure of response of the reticulo-endothelial cells (Krishnan, 1935). Our splenectomy experiments had corroborated this view and had established that spleen and the reticulo-endothelial system played an important part in its causation (Krishnan, 1935). These results, however, did not throw any light on the actual mechanism of hæmolysis. As hæmoglobinuria in the monkey is associated with an intense parasitisation and a severe metabolic upset, we presumed that certain derivatives of this abnormal metabolism may be responsible, under certain special conditions, for bringing about the hæmolysis and hæmoglobinuria. Therefore we studied the biochemical changes in monkeys suffering from hæmoglobinuria with special reference to cholesterol, total free and ester: total fatty acids; inorganic and organic phosphorus; and glucose. In all, nearly one thousand estimations were done and the results were

as follows:—(1) A condition of hypocholesterinæmia was present in the pre-hæmoglobinuric stage in the majority of cases and whenever the cholesterol value was normal or higher than normal, hæmolysis and hæmoglobinuria were inhibited. (2) The results tended to be more significant when the cholesterol was estimated as "free" and "ester" separately. A marked rise in ester-cholesterol and a fall in free-cholesterol were noticed in the pre-hæmoglobinuric state in all cases. (3) A rise in inorganic and organic phosphorus and a fall in glucose occurred in the pre-hæmoglobinuric state. These findings were interpreted as indicating a profound injury to the liver, with an upset of the carbohydrate and fat metabolisms and the production of hæmolytic substances such as fatty acids and lysolecithin. These were considered as being the agents that brought about hæmolysis. A detailed account of this work has been sent to the I. R. F. A. for publication in their annual report and a paper will also be submitted, at an early date, to the *Indian Journal of Medical Research* for publication. The value and significance of these results to human blackwater fever has been discussed in a paper on "The ætiology of Blackwater fever" appearing in the *Indian Medical Gazette* for March 1936.

Treatment of hæmoglobinuria.—Monkeys showing intense malarial infection and hæmoglobinuria were treated with the following drugs in addition to quinine:—cholesterol in olive oil, choline hydrochloride, choline phosphoric ester, glucose adrenalin, and glucose insulin. This work is still in progress and it is hoped that it would shortly indicate the line of treatment that would be most beneficial in these cases as well as in human blackwater fever.

Electrical charge of red cells.—The investigations on the electrical charge of infected and uninfected red cells in malarial monkeys commenced last year were completed this year. It was found that infected red cells, especially towards the end of schizogony, carried a lower charge than uninfected red cells. The results further indicated that biochemical alterations in the medium, specially those relating to the lipoids, probably influenced the charge of red cells and that these might be of importance in hæmolysis. Two papers were published during the year on this subject (*vide infra*).

Cholesterol changes in Kala-azar.—In view of the interesting results obtained with regard to cholesterol changes in malaria, which have recently been published by us (*vide infra*), it was decided to study this constituent in kala-azar as well for purposes of comparison. Twelve cases of kala-azar were therefore studied before, during and after treatment, and it was found that advanced cases of kala-azar showed a condition of hypo-cholesterinæmia while treated and cured cases showed a level which tended to be near normal values. Similar increase in blood cholesterol has been found after treatment and cure of typhoid fever, tuberculosis, pernicious anæmia and malaria. Cholesterol probably plays an important part in the regenerative processes associated with cure in these diseases.

Incidence of syphilis in the general population.—At the request of General Sir John Megaw we are conducting a survey of the general population for the prevalence of syphilis with the help of the Kahn test. So far as India is concerned there are but a few records of such studies. The present work is intended to throw light not only on the incidence of the disease but also on its distribution and import-

ance to public health. During the year under review three groups were studied, a military population, a jail population and an industrial population, each having a numerical strength of 300 to 400. The results showed an incidence of 6, 22, and 12 per cent. respectively in these groups. The work is still in progress and a more detailed report will be published when the investigation is completed.

Spontaneous tuberculosis in laboratory monkeys.—As a result of housing our experimental monkeys in the animal-room occupied by tubercular guineapigs there was an outbreak of acute miliary tuberculosis in the monkeys which caused the death of 14 out of 15 animals, and this seriously hindered our work in connection with malarial hæmoglobinuria. This outbreak was, however, completely investigated and a detailed report of it together with the interesting findings has just been published in the *Indian Journal of Medical Research* (*vide infra*).

Field Research.—Two malaria field centres were started, one at Naity (a low endemic malarial village) and the other at Abujhati (a hyper-endemic malarial village) within easy reach of Calcutta. The object was to compare the conditions prevailing in these two villages and from the knowledge gained to evolve, if possible, a cheap method of rural malaria control. During the year three surveys of the villages were completed and the results brought out some interesting points. Although it is too early to form any definite opinion regarding the factors that particularly favour the wider prevalence of malaria in Abujhati than in Naity yet the following points seem worthy of comment:—

Jute steeping.—In Naity the people use a majority of their tanks for steeping jute. This operation commences towards the end of August and early in September (*i.e.*, at the season of prevalence of carrier anopheles) and it appeared from our records of larval catches to be an important factor in reducing the prevalence of carrier anopheles in Naity. Jute steeping may be compared to the use of rotting vegetation advocated by Williamson in Malay for malaria control. It may be possible, through careful and judicious selection of tanks for steeping jute or through the use of rotting vegetation, to reduce anopheles breeding in rural areas. We propose to study the effect of this measure in Abujhati next year and to see how far it is successful in controlling rural malaria.

The value of local fish as larvæ destroyers.—A field experiment under controlled conditions was conducted to study the value of local fish as larvæ destroyers. Seven tanks more or less equal in size and similar in other respects were selected, and three species of fish (fry of carp, *Amblypharyngodon mola* and *Panchax panchax*) were introduced under different conditions. The results showed that no species of fish was of much use while vegetation was present. But when the tanks were cleaned the fry of carp and Panchax panchax reduced larval incidence to a large extent for a period of at least two to three months; later, however, the larvæ began to breed with the reappearance of vegetation. This finding suggests that the introduction of the fry of carp may be a beneficial and economical measure in rural areas, as the cost of cleaning the tanks and introducing this fish can be recovered by selling them each year before the commencement of the next malarial season.

Temporary v. *permanent breeding places.*—An interesting point of difference between the breeding places in Naity and in Abujhati was

that while in the former only 16 per cent. of the breeding places were of the temporary type in the latter 80 to 85 per cent. were of that type. It was thought that the complete drying up of the majority of the breeding places during several months in the year may lead to the production of conditions favourable for the breeding of carrier species during and after the rains. This view was supported by the records of larval catch which showed a greater prevalence of carrier species in the temporary breeding places than in the permanent ones. One method of reducing this anopheles prevalence would be by letting in plenty of silt laden water to fill them up just prior to the malarial season. If this is done anti-larval measures may not be needed either for the temporary or the permanent breeding places.

Help to outside agencies.—At the request of the Chief Medical Officer, East Indian Railway, we investigated the breeding places of Chironomous larvæ which were alleged to be responsible for an outbreak of enteritis in the railway colony at Lilooah. They were found breeding in large numbers in the drinking water-storage tanks and giving rise to large quantities of flocculent material. On the tanks being thoroughly cleaned and properly protected from the adult insects through wire-gauze screening no more fresh cases were reported.

Papers published during the year:

(1) Contribution to Protozoal Immunity, Part III, The Rôle of Electrical Charge in the Phagocytosis of Red Cells. *Ind. Jour. Med. Res., Vol. XXIII, 1, July 1935.*

(2) The Reticulo-endothelial System in Malarial Hæmoglobinuria of Monkeys, Part I. *Ind. Med. Gaz., Vol. LXX, 4, April 1935.*

(3) The Reticulo-endothelial System in Malarial Hæmoglobinuria of Monkeys, Part II. *Ind. Med. Gaz., Vol. LXX, 4, April 1935.*

(4) The Rôle of Electrical Charge in Phagocytosis of Red Cells in Malaria. *Trans. National Inst. Sciences of India, 1935.*

(5) Spontaneous Tuberculosis in Laboratory Monkeys. *Ind. Jour Med. Res., Vol. XXIII, January 1936.*

In the press:

(6) Cholesterol Changes in Malaria and Hæmoglobinuria of Monkeys. *Records Mal. Survey, March 1936.*

(7) Ætiology of Blackwater Fever. *Ind. Med. Gaz., March 1936.*

(8) Biochemical Studies in Malarial Hæmoglobinuria. *Technical Report, I. R. F. A., March 1936.*

(9) Cholesterol Changes in Kala-azar. *Ind. Med. Gaz., April 1936.*

(10) Treatment of Malarial Hæmoglobinuria in Monkeys. *Ind. Med. Gaz., May 1936.*

Acknowledgment.—I have great pleasure in expressing my indebtedness to the following officers whose willing help and co-operation greatly facilitated the work of this department. My thanks are due to Dr. Khambata, Director of Public Health, Bengal, for kindly

supplying the necessary quinine and cinchona febrifuge for distribution to the malaria cases attending our centres; to the Director and Assistant Director, School of Tropical Medicine, Calcutta, for giving us from time to time supplies of ordinary medicines for the use of the malaria centres; to Dr. L. E. Napier, Professor of Tropical Medicine, for allowing us to take samples of blood from his kala-azar cases for biochemical investigation; and to Col. Joshi, I.M.S., Officer Commanding, Indian Station Hospital, and to the Superintendent, Central Jail, Calcutta, for permitting us to take blood samples from the men under their charge for serological investigation. In addition, I feel it my duty to place on record my appreciation of the valuable services of my assistants but for whose co-operation it would not have been possible to carry out the large volume of work undertaken by the department. Dr. B. M. Ghosh needs special mention for his keenness and interest in the work of the two field malaria centres which are now under his charge and for his tact and ability to overcome the many difficulties involved. Dr. P. N. Bose has proved himself a diligent worker and is not only carrying out the investigations on syphilis but is also rendering help in the laboratory in various ways. Mr. N. G. Pai's industry and accuracy of technique have been chiefly responsible for the interesting results obtained in the biochemical investigations on hæmoglobinuria. Lastly, laboratory assistant G. S. Neogy's high sense of duty and technical skill both as a laboratory assistant and as a typist have been of immense help to the department.

REPORT OF THE MATERNITY AND CHILD WELFARE SECTION, 1935.

(DR. JEAN M. ORKNEY, M.B., Ch.B., D.P.H., W.M.S.)

The Maternity and Child Welfare Section at the All-India Institute of Hygiene and Public Health has been carried on, as in the previous year, under the severe handicap imposed by inadequate staffing and an inadequate and uncertain income.

The Governing Body of the Women's Medical Service lends to the Government of India a member of the senior cadre to act as Professor of Maternity and Child Welfare. The major portion of the running expenses of the section is also paid by the same body. The additional expenditure amounting to approximately Rs. 5,000 has to be met from money donated by generous individuals or by local bodies such as the Calcutta Health Week Committee, the Calcutta Turf Club and the Calcutta Football Association. The Calcutta Corporation has, in addition to grants in kind, sanctioned this year a recurring grant of Rs. 1,330. The collection of this money devolves on the professor and adds considerably to the difficulties with which she has to contend in promoting research or in keeping up the standard of teaching.

Diploma of Maternity and Child Welfare Course.—During the year 70 lectures on the organisation of maternity and child welfare and school medical services, infant and child development and care, school hygiene and child psychology were given to the Diploma of Maternity and Child Welfare students and 180 hours were allotted to field work, administrative and executive experience, inspection, supervision and report writing and clinical work from the preventive and constructive aspects.

Ten additional lectures were given to the Diploma of Public Health students on the organisation and administration of maternity and child welfare and school medical schemes.

With the permission of Lt.-Col. Murray, I.M.S., the students attended the Presidency General Hospital where Dr. Coltman gave ten clinical demonstrations on diseases of children. Dr. Coltman has for two years given these lectures honorarily and we are greatly indebted to him for the trouble he has taken to make the demonstrations both interesting and valuable.

Lectures and classes in other subjects were taken conjointly with the Diploma of Public Health students and this year the arrangements proved satisfactory.

One minor change in the curriculum has been made. Experience in the diagnosis and treatment of Venereal Diseases will in future be provided for at the Medical College instead of the Lock Hospital.

Two students completed the course and passed the diploma examination in August 1935. Of the four students who have now passed out one has been given a Rockefeller Fellowship and is in America studying western schemes for the protection of motherhood and childhood; one has been appointed Assistant Medical Officer for Maternity and Child Welfare, New Delhi; one is at the Vellore Medical School and the fourth has returned to hospital work.

There were no admissions for the 1935-36 course which started in October.

The reasons for the institution of the diploma and the need for medical women trained in public health methods were fully set out in the last annual report. Indian women doctors alone can completely gain the confidence of their own country women and carry conviction that new customs can and ought to be introduced into daily life. It is therefore deplorable that there are no Diploma of Maternity and Child Welfare students this year. Considered from another angle the absence of students is also to be regretted. Within the past year or two at least three senior posts in connection with Maternity and Child Welfare fell vacant and no Indian woman doctor was considered to have the necessary qualifications and experience by any of the local committees making the appointments. The Diploma of Maternity and Child Welfare qualification can be obtained in Calcutta, but experience must be provided by local authorities responsible for maternity and child welfare schemes. All those who have the interest of India at heart should see that the women doctors are first trained and then equipped with experience before they take over responsibilities for the guidance of maternity and child welfare in the various provinces of India.

Research.—Two main lines of research have been followed throughout the year—

(1) An enquiry into the health and nutrition of women jute mill workers with special reference to the effect of industrial conditions on the reproductive functions, and the health of the children during the first year of life.

(2) An investigation into the medical causes of infantile mortality and its correlation with the social, economic and environmental factors which influence the death rate.

Both enquiries are being carried out in connection with the field work of the Section at the Clive Jute Mill, and in Ward 8, Calcutta.

Analysis of the records already accumulated has demonstrated that the field work provides abundant material for research; it has indicated profitable lines of enquiry, but it has also shown the need for biochemical and bacteriological investigation to supplement the clinical findings and for an augmented staff to make use of the material.

The number of infant deaths for which there are records is too small to make publication of the statistical analysis justifiable at present and the collection of data will be continued if possible.

A preliminary report on the health of the woman worker in a jute mill is being prepared.

The consultative work of the section is increasing year by year, the teaching, administrative and executive duties do not diminish and if the proposals for an enquiry into maternal mortality and morbidity are accepted for 1936, it will be impossible to carry on the Section on its present minimum basis after the new D. M. C. W. session starts in October 1936. Time is short and there is urgent need for the Government of India to assume its obligations and to open, on a permanent basis, the maternity and child welfare section at the Institute.

Field Work.—The field work provides material for research and facilities for practical teaching. Reports of the Clive Jute Mill and the

Calcutta Health Week Maternity and Child Welfare Schemes are published separately.

Scholarships.—Dr. M. I. Balfour generously continued her scholarship during 1935-36 and has promised one more whenever a suitable candidate applies. The Maternity and Child Welfare Bureau, Indian Red Cross Society, also provides a scholarship and the Governing Body of the Women's Medical Service has deputed two of the members of the Training Reserve for study at the Institute.

On being transferred to Delhi, I handed over to Dr. M. I. Neal Edwards on December 13th.

REPORT OF THE CHOLERA INQUIRY.

(DR. R. W. LINTON, A.M., PH.D.)

The work of this Inquiry for the past year may be taken up under several headings. It should be emphasized, however, that these are not separate lines of investigation, but simply different points of attack on the same question, namely, the nature of the vibrio. Beginning in 1931 as a study of vibrio carbohydrates, the work of the Inquiry has expanded year by year, and has now covered a wide range of phenomena dealing with the bacteriology of cholera.

Classification.—The classification which emerged from the research into the chemical structure of the vibrios during 1932-34 has been extended by the study of a large number of new strains from various sources. All of these have fallen into one of the six chemical groups already established, and as they have come from the most varied sources, it is becoming more probable that we have isolated nearly all of the chemical constituents from the vibrio group as a whole. The simplicity of the classification, the interrelationships it reveals, and the correlation it shows between structure and origin, are its chief claims to consideration and adoption. A study made of the respiration and glycolysis of the vibrios in relation to chemical structure showed that a good correlation also existed between the type of metabolism and the constituents of the vibrios. Especially interesting in this respect was the finding that the Group IV vibrios, which comprise organisms from El Tor and from India, do not use glucose in the presence of oxygen. We are now in a position to give a chemical definition of this group which completely differentiates it from other vibrio groups, as follows:—"Vibrios found in India and El Tor, possessing a protein which racemizes from $-75°$ to $-14°$ in 250 hours in N/2 alkali, a polysaccharide built of units containing glycuronic acid *plus* galactose in aldobionic form, to which is added another molecule of galactose, and which in their metabolism fail to break down glucose in the presence of oxygen".

Similar definitions could be given of the other five chemical groups, which would differentiate them completely from Group IV and from each other.

Variation.—A typical example will give an idea of the present position in respect to variability. Strain 603 which was a glucose-containing strain, was subcultured *en masse* several times and finally showed by chemical analysis that it had developed some of the galactose-containing carbohydrate together with the original glucose-containing type. Plating of this strain showed two well-marked types of colonies where only one had originally been present, and on analysing these two types separately it was found that one of them contained glucose and the other galactose in pure form. In other words, the two components of the strains which had become mixed were separated. This kind of change, with separation of two distinct components, has occurred regularly, and can be obtained from almost any strain. The question now arises as to the source of this change. Is it a mutation in the sense that one type of chemical structure has given rise to another, or was

the original strain itself mixed with the galactose-containing organisms in such a minority that they could not be picked out in the analysis? If the first is the case, we shall have found the chemical basis of mutation in the vibrios, and if the second is the case, it means that few if any strains exist which are pure in the sense that they contain only one type of chemical structure. This problem can be definitely solved by the use of single cell cultures. If these show variation in chemical structure, the first possibility is proven; if they remain unaltered throughout all the various manipulations which we use to bring about dissociation, we can conclude that the second possibility is the correct one. Work with single cell cultures is now being undertaken.

Protein Analysis.—During the period under review, Mr. B. N. Mitra, M.Sc., of this Inquiry conducted a detailed research on the structure of the two proteins found in the vibrio group. This work, which showed a high degree of chemical skill, entailed the treatment of the two proteins with alkali, and the subsequent isolation from them of the actual amino acids of which they were composed. Mitra was able to show that in the configuration of the following amino acids the two proteins differed; glutamic acid, leucine, proline, and arginine; in respect to the other amino acids the two were identical. This study showed, as we had suspected since 1933, that we were dealing with two proteins having the same constituents arranged differently. It is interesting to note that differences in arrangement cause differences in properties, especially in toxicity as little as 0·15 mg. of protein II being fatal when given to a rabbit, while 10 to 50 times the amount of protein I has no effect whatsoever. Protein I, while not toxic for rabbits, is on the other hand highly toxic when given subcutaneously to man, as we have found in some unpublished experiments. Mitra's findings dispose of the suggestion made by other workers that proteins I and II are actually identical, but differ in the character or amount of some non-protein fraction which is carried along in the purification. As a final method of differentiating the two proteins their absorption spectra have been studied, and the results of this extremely delicate method have borne out the previous work. There can be no further question that the two proteins in the vibrio group do differ, and that their differentiation by racemization which is our routine method, is sound.

Work has also been begun on the further and more detailed analysis of the vibrio carbohydrates.

Metabolism.—The results of a study of sixty-seven strains were as follows: Metabolism is most active in the Group I vibrios found in cholera, somewhat less active in Groups II, V and VI, and least active in the water vibrios of Group III and in the aberrant "Medusa head" group. The El Tor vibrios, and the Group IV vibrios in general, are sharply marked off from the others by the absence of ærobic glycolysis. It was found that, as the vibrios change in chemical structure and in classification, their metabolism also changes to conform to that of their new groupings. Rough strains have lower metabolism than smooth strains and inagglutinable less than agglutinable strains. Finally, there is a good correlation between source, chemical structure and metabolism. Since this preliminary work a further series of 250 field and hospital strains has been completed, and these results will shortly be sent for publication. It is evident that metabolism is a useful addition to our methods of studying the vibrios.

Nature of H and O antigens.—With the application to the vibrios of the latest methods of serology, involving the use of heated and unheated suspensions in the experimental methods employed, it has become of interest to find out as much as possible about the effect of heat on the vibrios and about the nature of the H and O antigens. This work is being carried out under three headings. First, the effect of heat on the vibrios and on their various fractions. This work has been completed, and has given some interesting results. Second, the study of H and O antigens after their extraction from the vibrios. This part is still going on. We have been able to show that two types of agglutinable substance can be obtained from the vibrios, one giving a quick-forming, floccular agglutination at pH 2·6 and the other a slow-forming finely granular suspension at pH 5·2. How far these can be correlated with the granular and floccular portions of the vibrios is as yet uncertain, and it is possible that they represent the same protein under different physical conditions. The third method is to attempt the separation of the H and O agglutinogens by the passage of an electric current through a vibrio suspension. It has been reported that such a separation has been successfully accomplished with B. typhosus, and we expect to undertake it shortly in the vibrios, as the apparatus is now ready.

Cataphoresis and Salt Precipitation.—This work has been carried on in the hope that answers to various problems might be obtained by the study of the physical basis of agglutination. The following are some of the points on which we have obtained information: why two strains of the same chemical structure may not cross-agglutinate; why some strains will not agglutinate with their own antisera; why some strains agglutinate in some laboratories but not in others; why some strains vary from time to time in agglutinability; and why killing organisms make them less agglutinable. All of these points as well as others are being studied, and the application of this method should enable us to put a precise meaning to the terms ' agglutinable ' and ' inagglutinable ' which they do not have at present. One important point that has emerged is that in any agglutination reaction the salt is of equal importance with the serum. In fact the sole function of the immune serum is to protect the organisms against the action of the salt. This finding shows that considerably more care than is usually given should be expended in making up the ' normal ' saline used in these reactions, since far from being an inert constituent of the reaction, it is the most important of all. A paper on this work is now being prepared for publication.

Precipitin reactions.—These have involved so far purified protein I and protein II. It was found that a considerable degree of cross reaction occurred between, for example, an antiserum to protein I globulin and globulins prepared from protein II containing strains. In an attempt to do away with this cross-reactivity and to make the reactions more specific, various radicals such as atoxyl, sulphanilic acid, m-amino-benzoic acid, etc., have been introduced into the two proteins and antisera against these compounds have been formed in rabbits. The results show that a considerable narrowing of the reaction does occur, and that some of these antisera are specific for protein I or protein II, as the case may be. They have not yet been used in the agglutination reaction. The

significance of these cross-reactions and of the results obtained with modified proteins cannot yet be assessed, but the work is going on.

Minor studies.—Besides the work already discussed a number of minor points which do not require detailed description are also being studied. These include fermentation reactions, variation of vibrios under conditions of acidity and alkalinity, immunization with amines, etc.

List of Publications:

Indian Journal of Medical Research—

(1) Linton, Richard W., Mitra, B. N., and Seal, S. C. Studies on the Antigenic structure of *Vibrio cholerae*, Part VIII. The specific carbohydrate content and serology of the acid-soluble fractions, Vol. XXII, No. 4.

(2) Linton, Richard W., Shrivastava, D. L., and Mitra, B. N. Studies on the Antigenic structure of *Vibrio cholerae*, Part IX. Dissociation and changes in chemical structure, Vol. XXII, No. 4.

(3) Linton, Richard W., Harwant Singh and Seal, S. C. A study of vibrio filtrates, Vol. XXII, No. 4.

(4) Linton, Richard W., Mitra, B. N., and Mullick, D. N. Respiration and glycolysis of the cholera and cholera-like vibrios, Vol. XXIII, No. 3.

(5) Linton, Richard W., Mitra, B. N., and Seal, S. C. Further notes on the cholera and the cholera-like vibrios, Vol. XXIII, No. 3.

(6) Mitra, B. N. Racemization of proteins of *vibrio cholerae* and related organisms, Part I. Diamino acids, Vol. XXIII, No. 3.

(7) Mitra, B. N. Racemization of proteins of *vibrio cholerae* and related organisms, Part II. The monoamino acids, Vol. XXIII, No. 3.

Other Journals—

(8) Seal, S. C. Difficulties in the bacteriological diagnosis of cholera vibrios. Indian Medical Gazette, Vol. LXX, No. II.

(9) Linton, Richard W. A chemical basis for vibrio classification and variation. Bulletin mensuel de l'Office International d'Hygiene Publique, Vol. XXVII, No. 6.

REPORT OF THE TUBERCULOSIS ENQUIRY.

Financed by the Indian Research Fund Association.

[Dr. A. C. Ukil, M.B., M.S.P.E. (Paris) F.N.I.]

Work done in 1935: I. *Sunlight Experiments.*—Two papers on this subject have been submitted for publication in the *Indian Journal of Medical Research.* In one of them, which is on " the extent and intensity of extreme ultra-violet solar radiation with special reference to its therapeutic value ", a new method devised for measuring the intensity of sunlight has been described. In the other paper, which is on " the action of sunlight as a factor in controlling tuberculous infection in guineapigs ", are described the results of animal experiments done by exposing inoculated guineapigs (both haired and depilated) to direct and filtered sun's rays (by means of special filter glasses which admit a maximum amount of ultra-violet rays and a minimum amount of heat rays), keeping suitable controls for each group.

It was found that animals kept undisturbed in an open spacious shed, under natural conditions of fresh air and sunlight, survived longer than the other groups, whereas those confined in cages and exposed to direct (unfiltered) sunlight died sooner than the other groups. The distribution of visceral lesions, as shown in the following table, was much less extensive in the filtered rays group than in the other groups.

Average distribution of visceral lesions in the different groups.

—	Exposed to filtered Sun's rays. Group I.	Exposed to Direct or unfiltered Sun's rays but confined in cages. Group II.	Exposed to Direct Sun's rays with fresh air and freedom of movement. Group III.	Unexposed to Sun's rays, *i.e.*, kept in Room (Control). Group IV.
No. of animals employed.	16	16	6	16
Lungs . . .	18·7%	75·0%	50·0%	50·0%
Viscera . .				
Liver . . .	37·5%	75·0%	66·6%	56·2%
Spleen . .	43·7%	81·2%	83·3%	75·0%

No difference in dissemination of lesions was noted between the haired and depilated animals.

Although the number of animals employed in these experiments is not large and although markedly statistically significant results were not obtained, the experiments showed a longer survival period in Group III, while the dissemination of lesions was least extensive in Group I.

II. *Investigation on Tuberculosis in infancy and childhood.*—Two papers on this subject are being prepared for publication in the *Indian*

Journal of Medical Research, one on "the incidence of Tuberculous infection and disease in childhood" and the other on "Tuberculosis in Home-Contacts". The former is based on the results of cutaneous and intradermic tuberculin tests, X-Ray and autopsy evidences. On a comparative study of tuberculin sensitiveness in "contact" and "non-contact" children, it has been found that at about the age of 15 years the sensitiveness reaches 85·7 per cent. in "contact" cases as against 33·3 per cent. in "non-contact" ones. The other paper is based on the results of careful physical examination, supported by periodical Mantoux test and skiagraphic examination, of 268 children in tuberculous homes in the city of Calcutta. The following factors have been taken into consideration in deducing conclusions:—intimacy of contact, variation in racial groups, the difference between 'open' and 'closed' cases as sources of contact and the relationship with the source of infection, environment, and mortality. Several deaths were recorded among these children during the period of observation. Forty-six or 17·1 per cent. of the contact children showed potentially progressive infiltration in the lung parenchyma. Of these, 40 or 86·9 per cent. gave a positive Mantoux test either on the first or a subsequent test. Fifteen children showed latent or healed foci in the lung parenchyma. Definite evidence has thus been adduced regarding the extent and nature of tuberculous disease and of mortality as an important public health problem in this country. The following figures verify the above statements:—

Total No. examined.	Sources of Contact.			Other relations.	Mantoux test positive.	Lung Infiltration.			Latent or healed foci.	Hilar glands involved.	
	Father.	Mother.	Brother or Sister.			Right lung.	Left lung.	Both lungs.		+	++
268	58	84	56	70	196	21	19	6	15	95	36

This line of enquiry is not yet complete and is being continued in order to get more data on prolonged observation and to ascertain the tuberculosis mortality as against general mortality in tubercular homes.

III. *A comparative study of culture and animal inoculation as methods for isolating tubercle bacilli from pathological materials.*—This investigation was undertaken to find out the sensitiveness of culture media and to see if it could supplant animal inoculation in finding out tubercle bacilli from pathological materials.

Various media and methods of culture were first tested in order to find out the most suitable medium and method of culture. With regard to contaminated materials, the 'acid' digestion method and culture on Petragnini and Woolley and Petrik's media gave the best results. The observations were carried out on 131 samples of pus and pleural fluid and 185 samples of human autopsy materials. The 'acid' digestion method not only gave us a higher percentage of successful culture but the incidence of contamination was definitely less than with other methods of digestion and culture.

We next employed the following 288 materials from different sources both for culture on the finally selected media and for guineapig inoculation:—111 samples of pus and pleural fluid, 10 of sputum, 5 of urine, 3 of stool, 2 of skin, 1 of stomach wash and 156 of human autopsy materials. The autopsy tissues were also histologically examined for "giant cells". Of these 288 materials, tubercle bacilli were demonstrated in 102 materials, *i.e.*, 35·4 per cent., whereas the smear was positive in only 15·2 per cent. of the materials. Forty of these were positive by culture alone, 27 by animal inoculation alone and 35 by both the methods. Thus culture of tubercle bacillus on these media gave us positive information in 75 or 26·0 per cent. cases and animal inoculation in 52 or 21·5 per cent. cases. Culture appeared much earlier than the evidences obtained from inoculated guineapigs. Of 156 autopsy tissues, 14·7 per cent. were smear positive, 15·3 per cent. showed giant cells in sections, 25·0 per cent. were positive by culture and only 16·6 per cent. positive by animal inoculation. It has been shown that a suitable culture method is not only cheaper but also gives us earlier information as to the existence of tubercle bacillus in a pathological material. Since, however, animal inoculation gives us positive results where culture has been negative, it cannot yet supplant the latter. Hence, for more exact information, it is better to use both the methods. Where only one method has to be chosen, the culture method is preferable being cheaper and more successful.

A paper on this subject is being submitted for publication.

IV. *Portals of entry of the tubercle bacillus.*—With a view to find out whether the inhalation or the ingestion route operates for infection in this country and in order to type out the organisms, the various gland groups (cervical, tracheo-bronchial and mesenteric) of bodies autopsied at the Police Morgue and at the Medical College Hospital Morgue are being examined by histological methods, culture and animal inoculation. So far 143 bodies have been examined and 60 strains isolated. All the strains have proved to belong to the Human type.

V. *Types of Tubercle bacilli found in pulmonary and extrapulmonary lesions.*—A paper on this subject was published from this Inquiry in April 1933 number of the *Indian Journal of Medical Research;* but the number of materials examined was very small (only 60) and their nature not varied enough. Hence work on this subject is being continued. Since the publication of the last paper, 75 strains have been isolated from sputum (17), pleural fluid (28), pus (24), urine (2), stool (1), skin (2) and stomach washing (1). All of them have so far proved to belong to the human type.

VI. *The rôle of Allergy and Immunity in Tuberculosis.*—An attempt is being made to correlate histopathological findings in sections of lung tissues in tuberculosis with epidemiological and skiagraphic findings. The skiagraphic studies are being carried out at the Chest Department of the Medical College Hospital and the materials for histopathologic study are being obtained from the Medical College Hospital Morgue. The subject has recently attracted the attention of a few leading workers in Europe and America. The problem of allergy and immunity being entirely different in this country, it is necessary to explain the various manifestations, in indicating prognosis and treatment and in suggesting measures of control. Up till now 76 tuberculous lungs have been studied. This line of enquiry is being continued.

Post-graduate Course in Tuberculosis.—A post-graduate course in Tuberculosis was conducted at the Institute, lasting for 3 weeks, in the month of February 1935, under the auspices of the King George Thanksgiving (Anti-tuberculosis) Fund which was attended by 25 doctors from all over India and Burma.

Staff and Organisation.—The Officer in charge of this Inquiry is a voluntary worker. He has been ably assisted by Dr. S. R. Guha Thakurta, B.SC., M.B., who acts as the chief medical assistant, Dr. N. G. Mazumdar, M.B., who is in charge of histological work and Mr. A. G. Sinha, who attends to the preparation of media, care of animals, etc. I am glad to record here the able and loyal way in which they have helped me.

I take this opportunity to express my grateful thanks to Lt.-Col. A. D. Stewart, C.I.E., I.M.S. and to Dr. R. B. Lal, successive Directors of the Institute, for affording me accommodation and facilities for work at the Institute. I also desire to express my thanks to the authorities of the Calcutta Medical College and Hospitals and the Tuberculosis Association of Bengal for help in various directions.

Papers contributed during the year:

(1) The Tuberculosis Problem in India. *Indian Medical Journal, Vol. XXIX, No. 1, January 1935.*

(2) Lung Tuberculosis in Children. *Proc. Ind. Science Congress, 1935.*

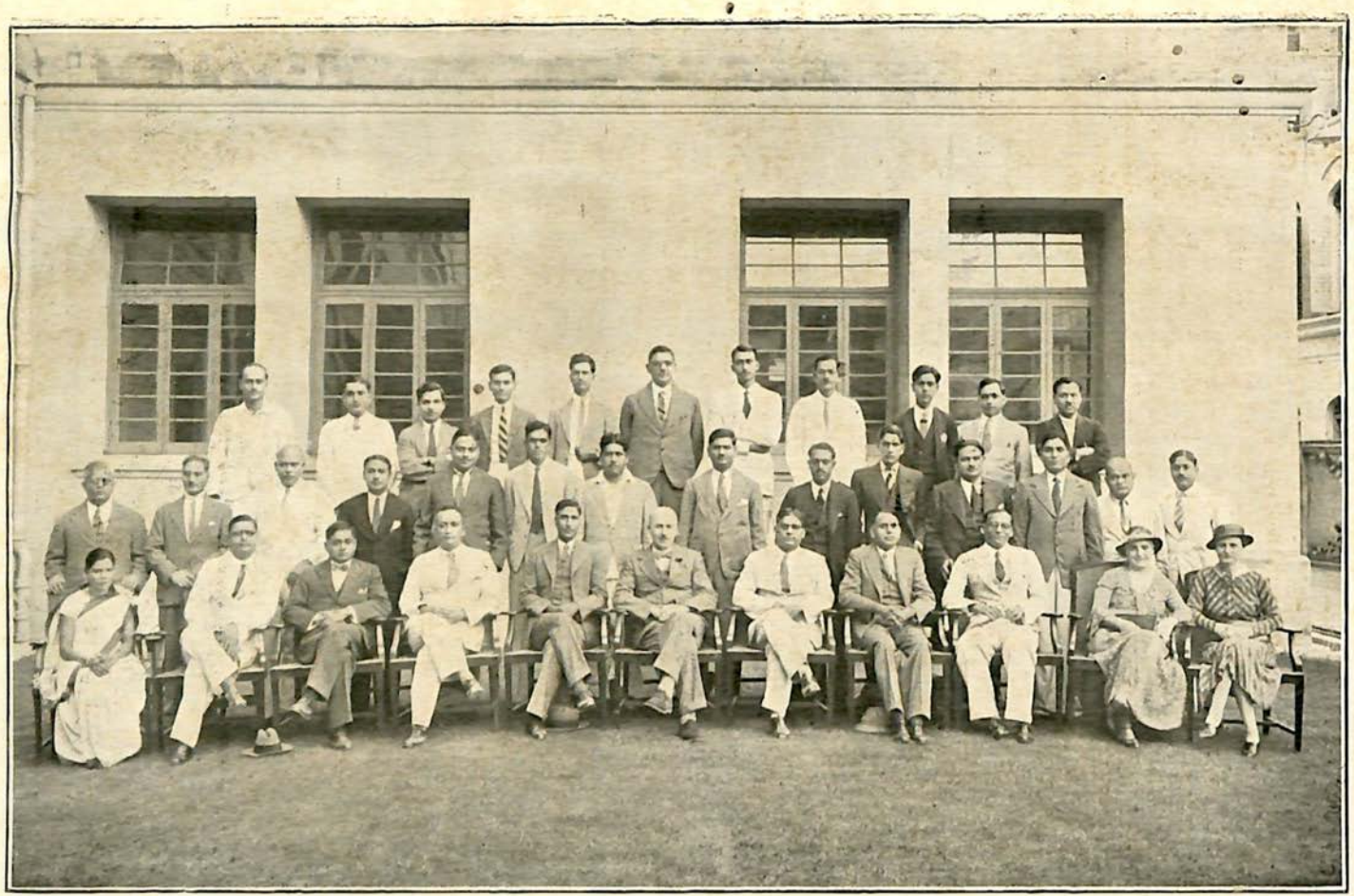
(3) The Rôle of Allergy and Immunity in Tuberculosis. *Ibid.*

(4) The Applicability of Phrenic Evulsion in Pulmonary Tuberculosis at the out-patients department of a city hospital (jointly with Drs. P. Chatterjee and K. N. De). *Ibid.*

(5) The extent and intensity of extreme ultra-violet solar radiation at Calcutta, with special reference to its therapeutic value (jointly with Dr. P. N. Ghosh and Mr. M. K. Sen). *Ibid.*

(6) Bronchiectasis, its ætiology, diagnosis, prognosis and treatment (jointly with Dr. K. N. De). *Ibid.*

(7) Abscess and gangrene of the lung (jointly with Dr. K. N. De). *Medical College Magazine, Vol. IX, No. 2, December 1935.*



TUBERCULOSIS CLASS FOR 1935.

SPECIAL POST-GRADUATE COURSE IN TUBERCULOSIS.

(Dr. A. R. Mehta, M.B.B.S., D.P.H., D.T.M. & H.)

One of the important aims of the King George Thanksgiving (Anti-tuberculosis) Fund is to improve the knowledge of medical practitioners in the diagnosis, treatment and prevention of tuberculosis and thereby to equip them with up-to-date methods of fighting the disease. With this end in view and with the permission of Lt.-Col. A. D. Stewart and the full support and co-operation of Dr. A. C. Ukil, a special training course in tuberculosis was organised by the Fund at the All-India Institute of Hygiene and Public Health, Calcutta, from the 4th to 23rd February 1935.

The class was limited to 25 students only, as this was considered to be the maximum number that could be handled effectively for demonstration and clinical purposes. The selection of candidates was made on territorial basis by the headquarters Committee of the Fund and the following were selected to attend:—

Dr. Lalit Kumar Barooah	Assam.
Dr. Baldeo Sahai Madan	Baluchistan.
Dr. Sudhindra Mohan Majumdar	Bengal.
Dr. Jadablal Banerji	
Dr. Anil Krishna Mukerjee	
Rai Sahib Dr. Balamakunda Nayak	Bihar and Orissa.
Dr. Kalidas Mitra	
Dr. Boloram Mukherjee	
Dr. Krishnaji Bhaurao Pathak	Bombay.
Dr. S. H. Kewalramani	
Dr. U. Tun Min	Burma.
Dr. G. R. D. Daniel	
Dr. S. K. Sanyal	Central Provinces.
Dr. K. G. Nerurker	
Major P. L. Burman	Delhi.
Dr. K. L. Kain	
Dr. P. R. Parasuram	Madras.
Dr. A. Venkatarao	
Dr. Mohammed Shah	North-West Frontier Province.
Dr. Partap Chandra	Punjab.
Dr. S. D. Ahuja	Rajputana.
Dr. Chandra Mohan Mathur	United Provinces.
Dr. Mohib Ullah Khan	
Dr. Krishan Murari Lal	
Dr. Mrs. C. Sarvama Naidu	Travancore State.

All the students made the best use of the opportunities offered, showed earnestness in the improvement of their knowledge and imbibed the spirit and enthusiasm to fight tuberculosis in India.

The session started at the Institute on the 4th February with a welcome by Dr. A. R. Mehta, Organising Secretary of the Fund, followed by an opening address on the Tuberculosis Problem in India by Colonel A. D. Stewart, the Director of the Institute. The classes were held from 10 a.m. to 4 p.m. every day and the following programme covering a large range of subjects bearing on the various aspects of the tuberculosis problem was gone through—

Date.	Hour.	Subject.	Lecturer.	Place.
4th February, Monday.	10 a.m.	Welcome . . .	by Dr. A. R. Mehta	Institute of Hygiene (Auditorium).
	10-15 a.m.	Opening address (the Tuberculosis Problem in India).	Col. A. D. Stewart	Do.
	11 a.m.	King George Thanksgiving Fund, its organisation, functions, etc.	Dr. A. R. Mehta .	Do.
	2-4 p.m.	The Tubercle bacillus (Lecture and Laboratory work).	Dr. K. V. Krishnan	Do.
5th February, Tuesday.	10 a.m.	Tuberculosis in Infancy and Childhood.	Dr. A. C. Ukil .	Institute of Hygiene.
	10-12 a.m.	Demonstration and examination of cases.	Dr. N. Mukherji .	Chest Department, Medical College Hospital.
	2-4 p.m.	Epidemiology of Tuberculosis (Lecture and demonstration).	Dr. A. R. Mehta .	Institute of Hygiene.
6th February, Wednesday.	9-10 a.m.	Pulmonary Tuberculosis in the adult.	Dr. A. C. Ukil .	Do.
	10-12 a.m.	Demonstration and examination of cases.	Do. .	Chest Department, Medical College Hospital.
	2-4 p.m.	Pathology of Tuberculosis (Lecture and demonstration).	Dr. M. N. De .	Pathology Department, Medical College.
7th February, Thursday.	9-10 a.m.	Pulmonary Tuberculosis in the Adult (contd.).	Dr. A. C. Ukil .	Institute of Hygiene.
	10-12 a.m.	Demonstration and examination of cases.	Dr. N. Mukherji .	Chest Department, Medical College Hospital.
	2-3 p m.	The portals of entry of the Tubercle bacillus.	Dr. K. V. Krishnan	Institute of Hygiene.

Date.	Hour.	Subject.	Lecturer.	Place.
8th February, Friday.	9-10 a.m.	Military Tuberculosis .	Dr. A. C. Ukil .	Institute of Hygiene.
	10-12 a.m.	Demonstration and examination of cases.	Do. .	Chest Department, Medical College Hospital.
	2-4 p.m.	Demonstration . .	..	
9th February, Saturday.	9-10 a.m.	The value of Laryngoscopy and Bronchoscopy in the diagnosis and treatment of lung diseases.	Dr. N. J. Judah .	Institute of Hygiene.
	10-12 a.m.	Demonstration of Laryngoscopy and Bronchoscopy in the diagnosis and treatment of lung diseases.	Do. .	E. N. T. Department, Medical College Hospital.
	2-4 p.m.	Laboratory diagnosis of tuberculosis.	Dr. K. V. Krishnan	Institute of Hygiene.
10th February, Sunday.	..	Holiday.		
11th February, Monday.	9-10 a.m.	The organisation of an Anti-Tuberculosis Dispensary.	Mrs. C. O. Remfry	Institute of Hygiene.
	10-12 a.m.	The value of Radiology in the diagnosis of lung diseases.	Dr. G. Galstaun .	Do.
	2-3 p.m.	Organisation for the control of Tuberculosis.	Dr. A. R. Mehta .	Do.
	3-15 p.m.	The rôle of the health visitor in the prevention of Tuberculosis.	Mrs. E. Muir .	Do.
12th February, Tuesday.	9-10 a.m.	Differential diagnosis of pulm. Tuberculosis.	Col. E. H. Vere Hodge.	Lecture Gallery, Medical College Hospital.
	10-12 a.m.	Demonstration in the Tuberculosis Wards.	Do. .	Medical College Hospital.
	2-4 p.m.	Immunity in Tuberculosis.	Dr. K. V. Krishnan	Institute of Hygiene.
13th February, Wednesday.	9-10 a.m.	Classification and Charting of Pulm. Tuberculosis.	Dr. P. V. Benjamin.	Institute of Hygiene.
	10-12 a.m.	Demonstration and examination of cases.	Dr. A. C. Ukil .	Chest Department, Medical College Hospital.
	2-4 p.m.	General principles of Sanatorium treatment, including grading of exercise and after care.	Dr. P. V. Benjamin.	Institute of Hygiene.

Date.	Hour.	Subject.	Lecturer.	Place.
14th February, Thursday.	9-10 a.m.	The position of the Medical treatment in Pulm. Tuberculosis.	Dr. P. V. Benjamin.	Institute of Hygiene.
	10-12 a.m.	Indications for and technique of Lipiodol diagnosis in lung disease.	Dr. K. N. De .	Chest Department and X'ray Department.
	2-4 p.m.	Surgical treatment of Pulm. Tuberculosis.	Dr. P. V. Benjamin.	Institute of Hygiene.
15th February, Friday.	9-10 a.m.	The position of the Medical treatment in Pulm. Tuberculosis —(contd.).	Do. . .	Do.
	10-12 a.m.	Demonstration and examination of cases (A. P. etc.).	Dr. A. C. Ukil .	Chest Department, Medical College Hospital.
	2-4 p.m.	Surgical treatment of Pulm. Tuberculosis —(contd.).	Dr. P. V. Benjamin.	Institute of Hygiene.
16th February, Saturday.	9-10 a.m.	Results of Sanitorium treatment in India, including after histories.	Do. . .	Do.
	10-12 a.m.	Operation of Phrenic evulsion (Demostration).	Dr. P. Chatterji .	Op. Theatre, Medical College Hospital.
	4-6 p.m.	Health Visiting with Tub. health visitors.	Drs. J. N. Mitter and S. Majumdar (as guides).	....
17th February, Sunday.	..	Holiday.		
18th February, Monday.	9-10 a.m.	The treatment of certain complications of Pulm. Tuberculosis (Haemoptysis, Pleural effusion, Spontaneous Pneumothorax, laryngitis, enteritis).	Dr. A. C. Ukil .	Institute of Hygiene.
	10-12 a.m.	Ditto ditto (Demonstration).	Do. . .	Chest Department, Medical College Hospital.
	2-4 p.m.	Ditto ditto	Do. . .	Do.
19th February, Tuesday.	9-10 a.m.	Non-tuberculous conditions simulating lung tuberculosis.	Dr. N. Mukherji .	Institute of Hygiene.
	10-12 a.m.	Operation of thoracoplastyits, application and technique.	Lt.-Col. F. J. Anderson.	Prince of Wales Hospital.
	2-4 p.m.	Tuberculosis Survey .	Dr. R. B. Lal .	Institute of Hygiene.

Date.	Hour.	Subject.	Lecturer.	Place.
20th February, Wednesday.	9-10 a.m.	Prognosis in Pulm. Tuberculosis.	Dr. A. C. Ukil .	Institute of Hygiene.
	10-12 a.m.	Demonstration and examination of cases.	Do. . .	Chest Department, Medical College Hospital.
	2-4 p.m.	Laws relating to Tuberculosis from the public health point of view.	Col. A. D. Stewart.	Institute of Hygiene.
21st February, Thursday.	9-10 a.m.	Some research problems in Tuberculosis.	..	Do.
	10-12 a.m.	Physical methods in the treatment of Tuberculous diseases.	Dr. G. Galstaun .	X'ray Department, Medical College Hospital.
	2-4 p.m.	Tutorial talk.	..	
23rd February, Saturday.	9-10 a.m.	The rôle of the general practitioner in the control of Tuberculosis.	Dr. A. R. Mehta .	Institute of Hygiene.
	10-12 a.m.	Tutorial talk.	..	
	4 p.m.	Group Photo of lecturers and students.	..	
	4-30 p.m.	Tea party by the Chairman and Members of the Executive Committee, Tuberculosis Association of Bengal.	..	

The Central Committee of the Fund defrayed the railway fares of all the selected candidates who attended the course.

I take this opportunity of expressing our gratitude to all those who co-operated in making the course a success and particularly to Lt.-Col. A. D. Stewart, Dr. A. C. Ukil, Dr. K. S. Ray and Dr. Mrs. C. O. Remfry.

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Annual Report of the All-India Institute of Hygiene and Public Health, Calcutta, 1936

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All-India Institute of Hygiene and Public Health, Calcutta.

Staff—1936.

Director.

Lt.-Col. A. D. Stewart, C.I.E., M.B., F.R.C.S.E., D.P.H., D.T.M. & H., I.M.S. (on leave preparatory to retirement from 13th September 1935).

Dr. R. B. Lal, M.B., B.S., D.P.H., D.T.M. & H., D.B. (Officiating).

Assistant Director.

Capt. K. G. Mohile, M.C., B.Sc., M.B., B.S., I.M.S. (R)., from 20th December 1935 to 17th December 1936.

A.—Staff of the Institute of Hygiene.

Department of Public Health Administration—

Professor—

Lt.-Col. A. D. Stewart, C.I.E., M.B., F.R.C.S.E., D.P.H., D.T.M. & H., I.M.S. (on leave preparatory to retirement).

Dr. R. B. Lal, M.B., B.S., D.P.H., D.T.M. & H., D.B. (Officiating).

Assistant Professor—

Dr. S. C. Ghosal, M.B. (CAL.), D.P.H., D.B.

Department of Vital Statistics and Epidemiology—

Professor—

Dr. K. C. K. E. Raja, L.M.S., L.R.C.P. & S., D.P.H., D.T.M. & H. (Officiating).

Assistant Professor—Vacant.

Mathematical Assistant—Mr. Satya Swaroop, M.A.

Department of Biochemistry and Nutrition—

Professor—Dr. H. Ellis C. Wilson, M.B. ch.B., D.Sc.

Assistant Professor Dr. Bashir Ahmad, M.Sc., Ph.D.

Department of Malariology and Rural Hygiene—

Professor—Dr. K. V. Krishnan, M.B., B.S., D.B., M.R.C.P., D.Sc.

Assistant Professor—Dr. Banamali Ghosh, M.B., D.P.H.

Assistant Research Worker—Dr. Phanindra Nath Bose, M.B., D.T.M., D.P.H.

Department of Maternity and Child Welfare

Professor—Dr. M. I. Neal-Edwards, M.D., W.M.S.

B.—Staff of the Calcutta School of Tropical Medicine.

Department of Protozoology—

Professor—

Lt.-Col. R. Knowles, C.I.E., B.A. (CANTAB.), M.R.C.S., L.R.C.P., I.M.S. (from 1st to 14th July 1936 and from 1st to 3rd August 1936).

Dr. B. M. Das Gupta, L.M.P. (DACCA), (Officiating from 15th to 31st July 1936 and from 4th August 1936 to 31st December 1936).

Assistant Professor—Dr. B. M. Das Gupta, L.M.P. (DACCA).

Department of Pharmacology—

Professor—

Bt.-Col. R. N. Chopra, C.I.E., K.H.P., M.A., M.D. (CANTAB.), M.R.C.P. (LOND.), I.M.S. (up to 14th July 1936 and from 15th August 1936).

Dr. J. C. Gupta, M.B. (CAL.) (Officiating from 15th July 1936 to 14th August 1936).

Assistant Professors—

Capt. Premankur De, B.SC., M.B. (CAL.), M.R.C.P. (EDIN.), late I.M.S. (on deputation).

Dr. J. C. Gupta, M.B. (CAL.) (Officiating).

Department of Public Health Laboratory Practice—

Professor—Dr. A. K. Sen, B.SC., M.B. (CAL.), D.P.H. (ENG.), M.R.C.P. (EDIN.).

Assistant Professor—

Dr. R. K. Banerji, M.B., D.P.H. (CAL.) (from 15th July 1936).

Mr. Nani Lal Banerjee, M.SC. (CAL.), A.I.C.

Department of Pathology, Bacteriology and Helminthology—

Professor—

Capt. C. L. Pasricha, M.A., M.B., B.CHIR. (CANTAB.), M.R.C.S. (ENG.), L.R.C.P. (LOND.), I.M.S. (from 1st January 1936 to 14th July 1936 and from 15th August 1936 to 31st December 1936).

Dr. G. Panja, M.B. (CAL.), D.B. (LOND.) (Officiating from 15th July to 14th August 1936).

Assistant Professor of Bacteriology -

Assistant Professor of Bacteriology—Dr. Ganpati Panja, M.B. (CAL.), D.B. (LOND.).

Assistant Professor of Pathology—Dr. Kalipada Banerjee, M.B. (CAL.), D.T.M. (CAL.).

Department of Entomology—

Professor—

Dr. C. Strickland, M.A., M.D. (CANTAB.), B.CHIR. (up to 30th October 1936).

Dr. D. N. Roy, M.D. (CAL.), D.T.M. (CAL.) (Officiating from 31st October 1936).

Assistant Professor—Dr. D. N. Roy, M.D. (CAL.), D.T.M. (CAL.).

Department of Serology and Immunology—

Professor—Major S. D. S. Greval, B.SC., M.D., Ch.B., D.P.H., I.M.S.

Assistant Professor—Capt. S. N. Chandra, M.B. (CAL.).

Department of Chemistry—

Professor—Dr. Sudhamoy Ghosh, M.SC. (CAL.), D.SC., F.R.S. (EDIN.), F.C.S. (LOND.), (up to 30th October 1936 and from 12th November 1936).

Assistant Professor—Mr. Nihar Ranjan Chatterjee, M.SC. (CAL.).

C.—Special Research Staff (under the Indian Research Fund Association).

1. Cholera Carrier and Epidemiological Enquiries—

Officer-in-charge—

(1) Capt. C. L. Pasricha, M.A., M.B., B.CHIR. (CANTAB.), M.R.C.S. (ENG.), L.R.C.P. (LOND.), I.M.S.

(2) Dr. R. B. Lal, M.B., B.S., D.P.H., D.T.M. & H., D.B.

(3) Dr. R. W. Linton, PH.D.

(a) *At Headquarters*—

Research Assistant—

Mr. K. C. Basak, B.A. (CANTAB.).

Bacteriologists—

Dr. Srish Chandra Seal, M.B.

Dr. Promode Chandra Das, L.M.F.

(b) *Field Section*—

Epidemiologist—Dr. Jayanta Kumar Bhattacharjee, M.B., D.P.H.

Assistant Bacteriologist—Dr. Monoranjan Kar, M.B., D.P.H.

2. Cholera Clinical Enquiry—

Officer-in-charge—Capt. C. L. Pasricha, M.A., M.B., B.CHIR. (CANTAB.), M.R.C.S. (ENG.), L.R.C.P. (LOND.), I.M.S.

3. Cholera Enquiry—

Officer-in-charge—Dr. R. W. Linton, PH.D.

1st Assistant—

Dr. D. L. Shrivastava, D.SC. (on leave up to 22nd June 1936).

Dr. B. N. Mittra, D.SC. (Officiating).

2nd Assistant—

Dr. B. N. Mittra, D.Sc.

Mr. D. N. Mullick, M.Sc. (from 17th August 1936 to 22nd September 1936).

Mr. B. N. Mozumdar, M.Sc. (Officiating from 23rd September 1936).

4. Tuberculosis Enquiry—

Officer-in-charge—Dr. A. C. Ukil, M.B.

Medical Assistant—Dr. S. R. Guha Thakurta, M.B.

Histologist—Dr. N. G. Mazumdar, M.B.

5. Black Water Fever Enquiry—

Officer-in-charge—Dr. K. V. Krishnan, M.B., B.S., D.B., M.R.C.P., D.Sc.

Research Worker—Mr. N. Gopala Pai, M.A.

6. Maternal Mortality and Morbidity Enquiry—

Officer-in-charge—Dr. M. I. Neal-Edwards, M.D., W.M.S.

Lady Doctors—

Dr. S. Pundit, M.B., B.S., D.M.C.W.

Dr. F. M. Shaw.

ANNUAL REPORT OF THE ALL-INDIA INSTITUTE OF HYGIENE AND PUBLIC HEALTH FOR THE YEAR 1936.

During the year under report, no changes in the staff of the Institute took place, except towards the end of the year, when Captain Mohile, Assistant Director, relinquished his charge on the completion of his probationary period and returned to his substantive appointment. The post of Assistant Professor of Vital Statistics and Epidemiology remained vacant throughout the year. The Institute has suffered a great loss in the death of Lt.-Col. R. Knowles, C.I.E., I.M.S., Professor of Protozoology in the School of Tropical Medicine. He will be long remembered as a capable teacher, an inspiring co-worker and a pleasant colleague.

The Maternity and Child Welfare Section was maintained as before by the Countess of Dufferin Fund. This arrangement has enabled us to keep up the continuity of this Section, particularly that of the Maternity and Child Welfare Clinic which is run in conjunction with it, till the Government of India assume the financial responsibilities. For this the Institute owes a debt of gratitude to the Governing Body of the Fund. In maintaining the clinic, Calcutta Corporation, Calcutta Health Week Committee, Raghumul Charity Trust, and certain other voluntary organisations have extended their co-operation, to all of whom the Institute is greatly indebted. The Sanitary Engineering Section remained in abeyance.

In its dual functions, as a centre for advanced studies in public health and for research, the Institute has made good progress during the year.

Teaching.—In previous years some seats in the D. P. H. Class, had remained vacant and, as mentioned in last year's report, some critics had doubted the necessity of providing a training centre for public health workers on such a large scale. This year's experience has shown that these misgivings were not justified. The number of candidates was half as large again as in the previous year. Not only all the 30 seats were readily filled up, but one extra seat had to be provided to accommodate a student for very special reasons. Besides, there were many more candidates who desired admission, but it was not possible to grant their requests. This increased demand for admission augurs well for the Institute and for the public health work in this country generally. It may be remembered that in commenting on the admissions last year, the opinion was expressed that in coming years the demand for training for public health workers will far exceed the present capacity of the Institute. This forecast has come true even sooner than was expected.

Courses held.

D. P. H. and D. P. H. & Hy.—The number of applications received this year was 74 as against 50 last year. Sixty-three candidates were graduates of Indian Universities, of whom 61 were eligible for admission to the next D. P. H. examination according to the

University regulations; of these 26 were admitted. Five students were admitted for D. P. H. & Hy. course.

The class was composed as follows:—

(1) *According to services*—

Provincial Government Services	4
District Boards	2
Municipal Boards	6
Indian State Services	1
Indian Medical Department	2
Private Practitioners	16
Total	31

Private practitioners still form the bulk of the students. It is, however, hoped that with the inauguration of the new Constitution, the launching of new public health programmes and formulation of schemes for sanitary improvements, particularly for the rural areas, will receive special attention on the part of the provincial Governments.

(2) *According to provinces*—

Bengal	14	(1 resigned.)
Assam	1	
Bombay Presidency	2	
United Provinces	3	
Central Provinces	1	
Bihar	1	
North-West Frontier Province	2	
Cochin State	1	
Punjab	1	
Madras Presidency	3	
Indian Medical Department	2	
Total	31	

Unlike last year, the largest contingent of students this year was from Bengal. The rest of the students represented practically all the other provinces of India.

Special Courses.—Four students joined these courses as against three last year. Three of them took the advanced course in malariology and one took the composite course. There is definite demand for special courses in other subjects, particularly tuberculosis. It is at present not possible to organise this course due to want of a trained assistant in the department.

D. M. C. W. Course. One student, a member of the W. M. S. joined this year. The demand for this course is also expected to increase.

D. Sc. (Public Health).—One student was enrolled for this degree. He has selected Biochemistry and Nutrition as his special subject.

The results of examinations held during the year compared favourably with those of previous years.

D. P. H., Part I, May and September 1936.—Twenty-one students including one remanded student appeared and 17 passed. All the four failed students were successful in their second attempt in September.

D. P. H., Part II, May 1936.—Four students appeared and all of them passed.

D. P. H., Part II, September 1936.—Twenty candidates took the examination and of these 17 were declared successful.

The importance of practical teaching was emphasised in last year's report. This point of view was kept in mind in general teaching, and the Health Officer, Calcutta Corporation, was requested to arrange the practical training under him, in such a way that it followed the theoretical lectures on various subjects, so that both the practical and the theoretical sides were presented side by side. There are practical difficulties in following this arrangement, but it is hoped that they will be overcome and the scheme will come in force in the near future. However, even then one would not feel satisfied with the available facilities for practical training. In Europe, the young D. P. H. serves as an assistant for a considerable period before he takes charge of a rural or an urban district. In this country opportunities to acquire practical experience under the guidance of a senior officer rarely occur, especially in the case of those who assume responsibilities for rural areas. It is, therefore, for consideration whether the purpose of public health training suitable for Indian conditions will not be better served by adopting more of the system followed in the Balkan States where practical rather than the academic aspect of training predominates in the curriculum.

However, the first step must necessarily be the provision of a rural and possibly also of an urban health unit where practical training may be imparted. In view of the impending changes in the Constitution, the Government of Bengal were naturally unwilling to take up financial responsibilities for a scheme, the continuance of which had to be guaranteed for many years. Attempts have been made to interest the authorities in the scheme and it is hoped that the position will now be reviewed and a rural health centre will be organised in the near future.

Considerable improvement in practical training in entomology was made.

Research and investigations.

Cholera.—Investigations into the causes of endemicity of cholera were continued and extended in certain directions. The inquiry remained under the direction of the Director, but the credit of the work at headquarters particularly that relating to the statistical portion of the inquiry and the analysis of data collected in the field, is mainly due to Dr. Raja and his staff. Due to the nature of the data, considerable technical difficulties were experienced in combining *thanas* into cholera districts. Complicated theoretical considerations were involved and it became necessary to refer the matter to Dr. J. O. Irwin, who after consulting Prof. R. A. Fisher, very kindly advised us that under the circumstances, we had to be content with the application of less rigorous tests.

A number of different techniques for forcasting cholera were tried. So far, the best method which has been evolved is the one which utilises the correlation between the cholera mortality in the last few weeks of a year and the total mortality in the succeeding year.

The field studies in the Diamond Harbour area were continued, but the incidence of cholera being exceptionally low this year, much progress could not be made with the investigations into the rôle of carriers in initiating epidemics. However, the tentative conclusions arrived at in the previous year were confirmed. Short notes on the progress made by this inquiry will be found in the report of the Professor of Vital Statistics and Epidemiology.

Dr. Linton has made further interesting contributions towards the study of the nature of vibrios. A perusal of his report will give an idea of his activities, but for proper appreciation of his work, papers published by him and his co-workers should be consulted.

Epidemic Dropsy.—While the field investigations had pointed towards mustard oil as the probable cause of epidemic dropsy there appeared to be no method of getting nearer to solution of the problem till October, when the Director visited Jamshedpur in connection with a fairly wide-spread outbreak. The data collected there provided very strong evidence in support of the mustard oil theory. We could now look forward more hopefully towards the results of the feeding experiments on human subjects, which had, so far, been unsuccessful.* An outline of this work will be found in Dr. Raja's report. Further work is in progress.

Nutrition and Biochemistry.—Dr. Wilson and his assistants have made considerable progress with the scheme of work as outlined in previous years' reports. Details will be found in the report of the Professor of Biochemistry. With regard to the nutrition surveys, our knowledge has greatly advanced as to the early signs of defficiency diseases, but the position regarding the methods of detection of low nutritional state is still unsatisfactory.

Dr. Wilson's studies on the basal metabolism of Indian children have brought out the fact that the number of calories required by children in India is no less than that required by them in Europe. Of other miscellaneous studies carried out by Dr. Wilson, the ones on the bisulphate binding power of blood in anæmia, dysentery, and epidemic dropsy, and the relation of cataract to defficiency of some elements of vitamin B complex require special mention.

Malariology, Tuberculosis and Venereal Diseases.—The activities of the Department of Malariology and Rural Hygiene included, as in previous years, both laboratory and field investigations. Dr. Krishnan's laboratory studies on black water fever now appear to be bearing fruit both in the academic sphere and in the practical field.

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* NOTE.—In experiments, carried out early in 1937, signs and symptoms of epidemic dropsy including gastro-intestinal disturbances, irregular rise of temperature hyperæmia and œdema of the legs and involvement of the heart were produced in 8 out of 11 persons fed on 'suspected' oil from Jamshedpur, while the controls remained quite healthy and cheerful. These experiments gave further information of practical importance for the control of the disease namely the length of the incubation or lag period.

In his report, Dr. Krishnan has drawn attention to certain important epidemiological features of black water fever in Jalpaiguri Dooars which merit investigations. Arrangements are being made for extending these studies to Jaipur Agency Tracts. The field studies in malaria by Dr. Ghosh mainly related to the question as to why *A. culicifacies* is of little or no significance as malaria carrier in Bengal.

Further progress was made with Dr. Bose's survey of the incidence of syphilis in Calcutta.

Dr. Krishnan has projected certain schemes of research in tuberculosis, but sufficient progress has not been made to pronounce any results.

Maternity and Child Welfare.—Reference was made in last year's report to the proposed enquiry into the chief causes of death associated with child birth, by a detailed field study. In the course of 6½ months during which period the enquiry has been in progress, some data have been collected and analysed. A summary of results will be found in the report of the Professor of Maternity and Child Welfare.

Tuberculosis.—Dr. Ukil mainly followed the same lines of work as in previous year. A perusal of his report will give an idea of the range of problems connected with the epidemiology of tuberculosis in India which he has carefully studied.

Visit of Their Excellencies the Viceroy and Marchioness of Linlithgow.—The Institute was honoured by a visit by Their Excellencies the Viceroy and Marchioness of Linlithgow. Brief though this visit was, it was a source of great encouragement to the members of the staff and other workers. The distinguished visitors were received by Colonel A. J. H. Russell, C.B.E., K.H.S., I.M.S., Public Health Commissioner with the Government of India and the Director.

Stipends.—The D. M. C. W. student availed herself of the stipend of Rs. 50 which was kindly offered by the Indian Red Cross Society. Another scholarship worth Rs. 30 was generously presented by Dr. Balfour, but no suitable candidates applied.

Accommodation.—With a view to increasing the efficiency of the work, considerable re-arrangment in the allotment of accommodation had to be made. The main principle followed was to make three units available for each of the six sections and to provide room for expansion for three departments in the eastern wing on their respective floors.

Considerable difficulty is felt by the students, especially by those who come from other provinces, in finding suitable residential accommodation in the vicinity of the Institute. In view of the long hours of work which the D. P. H. Course entails, provision of such accommodation would be very welcome. For the women students particularly, residence near the Eden Hospital is absolutely necessary, as they are expected to be available at all time for attendance on delivery cases. It is becoming increasingly difficult to find suitable accommodation for them. A scheme for erecting a building in the compound to accommodate 30 students, the cost of which was to be met out of the unspent balance of the Construction Fund, was submitted. In preparing the design, possibilities of future expansion of the activities of the Institute were kept in mind and it was arranged that the residential rooms, if and

when required, could be converted into laboratories without much structural alterations.

Museum.—The Museum has been re-arranged and considerably extended. Additions to it will, of course, continue to be made year after year.

Library.—One hundred and thirteen books, one hundred and sixty-four reports, and 110 bound volumes of journals were added to the library. Total number of volumes in the library has now reached 5,048. The number of journals received is 67. Closer contact with the School of Tropical Medicine has been established with a view to preventing unnecessary duplication of books and journals in the two institutions.

Manual.—A Manual prescribing rules for the administration of the Institute which was still in draft form was thoroughly revised and partly re-written.

General Observations.—Besides the visit of Their Excellencies the Viceroy and Marchioness of Linlithgow which has been recorded in a separate paragraph, the Institute was visited twice by the Director General of the Indian Medical Service, and twice by the Public Health Commissioner with the Government of India. Amongst other distinguished visitors may be mentioned the names of Dr. E. J. Pampana, Secretary of the Malaria Commission, League of Nations, Professor C. D. De Langen, formerly Dean of Faculty of Medicine, Batavia, Dr. H. G. Morin, Director, Pasteur Institute, Indo-China, and Dr. Anderson, Secretary of the British Medical Association.

As in previous years, with a view to keeping the members of the staff acquainted with each others work, monthly meetings of Professors, Assistant Professors, and Officers-in-charge of the Enquiries were held at which notes regarding the current work in different departments were exchanged. At these meetings the members of the staff were also given opportunity to offer suggestions for improvements in the affairs of the Institute.

A few joint meetings of the senior members of the staff of the two institutions were also held with the object of interchanging ideas and hearing the contributions of the various workers in their respective subjects.

It was felt that establishment of personal contact between teachers, research workers and those engaged in public health administration would be to the mutual advantage of all. With a view to promoting such contact and encouraging discussions on public health problems, a Public Health Society was organised and monthly meetings were held. The promoters of the Society hope that in due course the activities of the Society will extend to other provinces and will result in the formation of an All-India Organisation.

With similar objects in view the Directors of the two institutions arranged to hold joint monthly meetings in the School of Tropical Medicine under the auspices of the Royal Asiatic Society of Bengal. Students were freely admitted to the meetings of both Societies. These institutions have helped to create an academic atmosphere, the need of which was so keenly felt.

The Institute of Hygiene Club, membership of which is open to the staff and students of the Institute was organised with the objects of promoting social contact, managing the restaurant in an efficient manner, and providing facilities for outdoor games.

Stores.—Sanction of the Government for special facilities with regard to the local purchase of stores was obtained. This together with the new system of obtaining indents from different departments in advance has regularised the purchase of stores and has provided better facilities to the workers.

The Institute co-operated, as in previous years, with a number of official and non-official organisations in the promotion of welfare work of diverse nature.

One month's post-graduate course in tuberculosis under the auspices of the King George's Thanks Giving (Anti-tuberculosis) Fund was held on the same lines as described in last year's report.

Acknowledgments.—It is a pleasure to record my gratefulness to my colleagues, co-workers and members of the ministerial staff for the help and co-operation which I received from them throughout the year. Bt.-Col. R. N. Chopra, C.I.E., K.H.P., I.M.S., Officiating Director of the School of Tropical Medicine, to whom my special thanks are due, has obliged me by giving the benefit of his valuable advice on numerous occasions and by taking keen interest in the welfare of the Institute. I am also glad to acknowledge with thanks the help and co-operation which I have received from other members of the staff of the School.

Our thanks are also due to the Superintendent and teachers of the Campbell Hospital and to the Health Officer and District Health Officers of the Calcutta Corporation who have taken an important part in the practical training of our students.

The funds generously placed by the Indian Research Fund Association at the disposal of the various enquiries have been of the greatest assistance in our research and investigations. Our grateful thanks are due to the Governing Body of the Association for this continued help. Among other people who have been of assistance to us in our work, the names of Major-General D. P. Goil, K.H.P., I.M.S., Dr. L. M. Biswas (the Health Officer of the Calcutta Corporation), Lt.-Col. M. A. Singh, I.M.S., Major S. L. Patney, I.M.S., Lt.-Col. M. Das, I.M.S., and Dr. J. O. Irwin deserve special mention. We are also grateful to Dr. W. P. Jacocks, and the members of the International Health Board of the Rockefeller Foundation for granting a fellowship to Dr. B. N. Mitra, a research worker of the Institute.

*REPORT OF THE PROFESSOR OF VITAL STATISTICS AND EPIDEMIOLOGY FOR THE YEAR 1936.

(Dr. K. C. K. E. Raja, L.R.C.P. & S., D.P.H., D.T.M. & H.)

The work of the department falls under two heads, teaching and research.

Teaching.—The students preparing for the Diploma in Public Health of the Calcutta University receive a course of lectures on the general principles of epidemiology and the special treatment of three diseases, diptheria, cholara and plague in order to illustrate respiratory, alimentary and insectborne types of infection. As regards statistics, the course includes the collection and methods of compilation of vital statistics in India and their utilisation for the assessment of the health of a community as well as the elements of modern statistical technique, including correlation, probability, the principles of sampling and significance tests.

The lectures are supplemented by practical classes and demonstrations both in the case of epidemiology and of vital statistics. During the 1935-36 session there were forty-two lectures and thirty-two practical classes.

In addition to the above course a special course of three months is available for persons who want to pursue the subject further. During the year an Assistant Director of Public Health from Burma underwent the three months' course and there was also a Fellow of the Rockefeller Foundation who underwent a year's training in Epidemiology and Vital Statistics.

During the year I continued to discharge the combined duties of the Professor and Assistant Professor and had therefore to face heavy work, particularly with respect to the teaching of the students. Mr. Satya Swaroop, the Mathematical Assistant, carried out part of the work in regard to the programme of studies for the Rockefeller Foundation Fellow by giving him a course of instruction in Mathematics.

Research.—In last year's report a summary was given of the findings of two enquiries that have been in progress, one relating to cholera and the other to epidemic dropsy. During the present year these researches continued. A brief account of the results is given below. For a more detailed account reference may be made to Dr. R. B. Lal's reports in the Report of the Scientific Advisory Board of the Indian Research Fund Association for the year 1936-37.

(1) Cholera research.

An important piece of research on which the Department has been engaged is the Cholera Carrier and Epidemiological Enquiry under the Indian Research Fund Association.

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* Part of the research work reported here was carried out in the Department of Public Health Administration. The two enquiries, namely, the Cholera Carrier and Epidemiological Enquiry and the Epidemic Dropsy Enquiry, continued to be under the direction of Dr. R. B. Lal. It has therefore been found convenient to present the research work carried out in the two Departments in a joint report.

It was pointed out, in the two previous reports of this department, that there were two enquiries, (1) a field investigation in 16 villages, with a population of about 10,000, in Diamond Harbour *thana* of 24-Perganas district of Bengal and (2) a statistical study of cholera mortality figures of Bengal for the period 1901-32.

The Field Study.

How are cholera outbreaks generated? How is the infection kept up during the inter-epidemic periods? What are the changes that the cholera vibrio undergoes in the human gut of the patients, the convalescent carriers, the contact carriers and other carriers? Is there a change from virulence to avirulence and back again and, if so, under what conditions? Do similar changes occur in the vibrio in nature, and if so, under what conditions? These are important questions which require answers for the elucidation of the cholera problem. The questions admit of no easy solution because of the absence of an experimental animal which can reproduce clinical cholera and also because of the serious nature of the disease which prevents experiments on human beings. Under the circumstances all that we can do is to accept cholera epidemics as experiments conducted by Nature for us to observe and interpret. In field experiments there are so many variable factors beyond our control that we cannot hope to obtain the precision of laboratory studies. Our interpretation of results has therefore to be much more cautious and a larger range of data is required for drawing conclusions than in the case of controlled experiments. Dependent, as we are, on natural happenings for our study, progress will necessarily be slow. The results of the field studies have to be interpreted in the light of the above remarks. Since the investigations are of a continuous nature it is not possible to isolate the results obtained during the year from those of the previous years. Hence the whole period of the enquiry, from 1st July 1934 to 31st December 1936, has been included in the summary that is set out below:—

Origin of Epidemics.

Outbreaks of cholera can, in the area under investigation, be explained on most occasions by case to case transmission of infection. In two instances the carrier was, as far as is known, the only source of infection apart from environmental sources, which cannot be excluded in an endemic area, as vibrios can frequently be isolated from tanks, canals and other water supplies. In a third case, though the outbreak was associated with a carrier, the patient was himself a carrier prior to the onset of the disease and hence the possibility of a clinical relapse could not be ignored. In five more cases the chain of evidence connecting the carrier with the outbreaks was not quite so complete as in the others.

Spread of infection.

Outbreaks of the disease may be divided into (*a*) epidemic, *i.e.*, those in which the primary case is followed, within an arbitrary period of 15 days of onset, by secondary cases and (*b*) sporadic cases, *i.e.*, isolated cases unconnected with one another. There were altogether 28

outbreaks between 1st July 1934 and 31st December 1936, of which 16 were epidemic and 12 sporadic.

An interesting finding is that the rate of spread of infection from epidemic cases to their contacts in significantly higher than that from sporadic cases to their contacts, even after making allowance for the greater length of period of exposure and the larger quantum of infection in the case of the former.

The infection rate among the contacts of epidemic cases is also significantly higher than that of the general population, which suggests that we are here dealing with a true transference of infection from cases to their contacts and not with a group of persons who might have had their infection from other sources.

There is no reason to believe that the facilities for the spread of infection, such as those due to the habits of the people, differed in any marked degree between the two types of cases. The question therefore arises whether this higher rate of dispersion is associated with the nature of the organism itself.

**The serological reactions of vibrios from cases of cholera.*

About 62 per cent. of the cases gave agglutinable vibrios, about 11 per cent. non-agglutinable ones and from the remaining 27 per cent. no vibrios could be isolated on repeated examinations ranging from two to five.

In carrying out these agglutination reactions a combined H and O serum of titre 2,000 raised against Kasauli No. 1617 supplied by the Central Research Institute, Kasauli, was used during the period from 1st July 1934 to 1st November 1935. From the latter date onwards the tests were carried out against (1) a non-differential Inaba O serum, (2) a type-specific Ogawa O serum and (3) an H and O serum prepared with live cultures of Inaba or Kasauli No. 1617, titre not exceeding 5,000.

Clinical Classification of Cases.

When cases were divided on clinical grounds into severe, moderate and atypical it was found that the proportions of severe cases among the agglutinable and non-agglutinable types of vibrios were not significantly different. On the other hand the cases from which no vibrios could be isolated had a definitely smaller proportion of severe cases among them than the ones which yielded either of the two types of organisms.

Organisms carrying the Inaba ' O ' antigen have, by certain authorities, been ascribed a choleragenic role. The group of Inaba ' O ' positive cases showed, however, no significant difference in severity of disease from that associated with non-agglutinating vibrios.

* The isolation of the vibrios and their routine examination were carried out in the Department of Bacteriology of the Calcutta School of Tropical Medicine under Capt. C. L. Pasricha, I.M.S., and a more detailed study of certain selected strains at the Central Research Institute, Kasauli, under Colonel J. Taylor, I.M.S.

The chemical constitution of vibrios isolated from cases of cholera.

All strains isolated from clinical cases of cholera have shown similarity in that they possess the same protein fraction. Strains isolated from primary cases show identity in chemical constitution with those derived from secondary cases. But the chemical grouping is not able to differentiate between epidemic and sporadic cases nor between the clinically severe, moderate or atypical cases.

Persistence of Infection.

I. *Man:*

(a) *Convalescent carriers:* The average period of persistence of infection is 33 days, the range of variation being from 3 to 98 days.

(b) *Contact carriers:* Average period is 42 days and the range from 17 to 136 days.

(c) *Other carriers:* Average period is 28 days with a range from 6 to 113 days.

In regard to the Inaba 'O' positive carriers, the available data give 21, 19 and 23 days as the average periods of persistence of infection for the convalescent, contact and other carriers respectively.

II. *Environment:*

Vibrios have been isolated from tanks, flies and fish for varying periods.

(a) *Tanks:* During the whole period 169 tanks were examined and of these 77 gave positive results or a percentage of 45·56. The total number of samples examined from these tanks was 5,124, with 1,019 positive results, or a percentage of 19·89. One of these tanks, No. 3 in village No. 3, yielded irregularly positive and negative results from the time of commencement of examination (March 1935) up to the end of 1936 and even later, in spite of its complete exclusion from outside contamination except possibly by birds. The vibrios isolated were, on most occasions, non-agglutinable, though occasionally agglutinable strains were also obtained. A canal close to this tank was first examined in July 1935 and it also yielded positive and negative results up to the end of 1936. It is subject to the tidal ebb and flow from the Hoogly and the people use it mostly for fishing.

Seven water supplies, among the 77 found positive, yielded Inaba 'O' positive vibrios. Tank No. 3 of village No. 3 and the canal belong to this group of seven and they gave Inaba O positive results during a period of about nine and a half months.

(b) *Flies and fish:* The variation of vibrios in flies and the types of vibrios and their persistence in the naturally infected fries of fishes were investigated.

(i) *Flies:* For these experiments it was desirable that the flies used should, if possible, be free from bacteria. Attempts were therefore made to breed them in the laboratory under aseptic conditions. Among the disinfectants used to sterilise the eggs, mercuric perchloride, 1 in 1,000 solution acidified with $\frac{1}{2}$ per cent. hydrochloric acid, gave the

best results, though complete sterilisation was possible only in exceptional cases. The flies, which were bred out, were free from gram negative organisms but spore-bearing aerobes could not be entirely eliminated. The flies were found to be ' phage-free '.

A batch of laboratory bred flies was fed with vibrios from known sources. At definite intervals a certain number of the flies was singed, crushed and cultured for the recovery of the organisms. The examinations were carried out immediately after feeding the flies as well as after 6, 12, 24, 48, 72, 96, 120, 144 and 168 hours. In this series of experiments the longest interval after which vibrios could be recovered was 120 hours.

The recovered vibrios were examined for any variations that might have occurred with respect to morphological, biochemical, structural, metabolic and serological characteristics. The experiments were carried out with two strains, one being agglutinating and the other non-agglutinating.

The agglutinating vibrio: This strain (No. 610) reacted with Inaba O and H and O sera. It gave typical biochemical reactions and was 'phage-free. It was isolated from a clinical case of cholera. By chemical examination the strain belonged to Linton's group I.

Morphological variations were observed, the recovered organisms being, on some occasions, shorter, thicker and less curved and on others longer and finer. But these variations were lost on sub-culture.

No change was observed in biochemical and serological characters.

As regards metabolism the respiration values showed less variation than those for glycolysis. There was a definite tendency for a decrease of the glycolytic power.

With respect to the chemical structure, no change took place at the end of 12 hours but, after 48 hours, the carbohydrate fraction, which was galactose to start with, became a mixture of galactose and glucose, the protein fraction remaining unaltered. At the end of 120 hours the protein changed into protein II and the carbohydrate into glucose. Thus the organism underwent a change from Linton's group I to a mixture of groups I and VI in 48 hours and to group V in 120 hours.

Non-agglutinating vibrio: This strain (No. 2252) was derived from a tank in one of the experimental villages in Diamond Harbour. No case of cholera had occurred in that village for a period of about five months prior to its isolation. It was inagglutinable with Inaba O and H and O sera and biochemically belonged to Heiberg's group I. It was 'phage-free. Flies were fed on this strain and the vibrios isolated 48 hours after the feed were passaged through other flies. In this way ten serial passages were carried out. A certain number of flies from each passage was killed at intervals of 6, 12, 24 and 48 hours and the vibrios recovered from them were examined.

As in the case of the agglutinating vibrio the morphological variations were not permanent and no serological and biochemical changes could be observed.

On the other hand, interesting results were obtained with respect to changes in chemical structure and metabolism. Examined chemically the original tank strain belonged to Linton's group V. It gave a

moderately high respiration figure but glycosis was zero. At the fourth passage the organisms recovered from flies six hours after feeding them gave a very high glycolytic figure of 9·4 and chemically the vibrios changed into group I, which involved an alteration both of the protein and the polysaccharide. But the high glycolytic power was very unstable in that the examinations at the end of 12, 24 and 48 hours of the same passage showed low figures. Though no chemical examination was carried out, this change to low glycolitic power suggests that the vibrios must have undergone a change from Linton's group I. The subsequent passages did not show any great rise in the figure except at the 8th passage, when it became 9·0.

The results may prove to be of great importance. Linton and his co-workers have shown, by their study of the chemical constitution of about a hundred strains of vibrios, that there is a close correspondence between chemical structure and the sources of origin of the organisms. Group I has always been found to be associated with vibrios isolated from cases of cholera. On the other hand group V has been associated with organisms derived from tanks and carriers or with variants produced in the laboratory by special treatment. A more extended study by them of 210 strains by metabolic tests, whose results they demonstrated permitted the grouping of vibrios on the same basis as the results of chemical analyses, confirmed in general the above findings. Under the circumstances, if it is permissible to assume that group I can be accepted as a criterion of pathogenicity and group V of the non-pathogenic state of the vibrio, then the results of the fly experiments assume considerable importance in regard to the epidemiology of cholera. What has been demonstrated is that a strain belonging to group I from a case of cholera underwent in the fly, in 120 hours, a change from group I to group V and that the reverse change, though of no long duration, took place with respect to a tank vibrio belonging to group V on repeated passages through flies. Changes from group I to other groups, including group V, have been demonstrated in the laboratory by the special treatment of vibrios. On the other hand the present observation is the only instance of a strain belonging to group V being converted into group I.

The field epidemiological studies at Diamond Harbour have shown that, in a small proportion of cases, the initiation of outbreaks cannot be ascribed to the transmission of infection from patient to patient. In this area the vibrios persist for fairly long periods of time in the carrier and in nature. Can it be that, under certain circumstances which are not understood, the fly can play the part of activating the organisms in the environment and can thus cause outbreaks of the disease? The change into group I was, as has been pointed out already, one of very short duration. Moreover, it is an isolated observation. Therefore a final judgment must be suspended, though the importance of the ovservation cannot be ignored.

(ii) *Fish:* Fries of fish belonging to species locally known as Mrigal (*Cirrhina mrigala*) and Catla (*Catla catla*) were obtained from the market. They were found to be naturally infected with vibrios. They were kept in an aquarium and arrangements were made to maintain a slow but continuous flow of water. One hundred c.cm. of water was daily removed from the aquarium and tested for the presence of vibrios.

Three experiments were performed and the results are summarised below:—

Experiment I: It was started on 16th July 1936 and had to be discontinued at the end of the month owing to the death of the fish. Vibrios were isolated throughout this period.

Detailed examination of five strains was carried out; the results are shown below:—

No. of strains.	Saccharose.	Manose.	Arabinose.	Remarks.
5	–	+	–	(Heiberg's group V.)

None of them agglutinated with Inaba O or H and O serum.

Experiment II: It was started on 17th August 1936. Vibrios were isolated till 3rd October 1936 (48 days). The main characters of thirty strains examined were as follows:—

No. of strains.	Saccharose.	Manose.	Arabinose.	Remarks.
21	+	+	–	(Heiberg's group I.)
6	–	+	–	(Heiberg's group V.)
3	+	–	–	(Heiberg's group II.)

Metabolic tests of 18 strains were carried out; five belonged to Linton's groups I and VI, which are for practical purposes indistinguishable by these tests, while the rest were in either group IV or group V.

None of them reacted to Inaba O or H and O serum.

Experiment III: This was started on 17th September 1936 and vibrios were isolated till 30th October 1936 (44 days). Sugar reactions were tested for 28 strains. The following results were obtained.

No. of strains.	Saccharose.	Manose.	Arabinose	Remarks.
21	–	+	–	(Heiberg's group V.)
5	+	+	–	(Heiberg's group I.)
2	+	–	–	(Heiberg's group II.)

Fourteen strains were subjected to metabolic tests. Five strains belonged to Linton's groups I and VI. The others belonged to group IV or V.

None of them agglutinated with the Inaba O or H and O serum.

The significance of the presence of these organisms in the fish is not understood.

Changes undergone by the vibrios.

In many instances the serological reactions of vibrios isolated from secondary cases or from persons in contact with cases did not correspond with those of the primary cases. In regard to the former there can be little doubt that their source of infection must have been the primary cases. With respect to the latter the source is also likely to have been the patients, inasmuch as the rate of infection among the contacts was found to be significantly higher than that of the general population. These facts suggest that vibrios are possibly undergoing serological changes in the course of transmission from patients to those in immediate contact with them.

The strains derived from patients, their healthy contacts and secondary cases fell into groups I and VI on the basis of metabolic tests, except in one instance. Hence the chemical structure, in so far as it can be inferred from these tests, showed little change. Chemical structure appears to have greater stability than serological reaction.

With respect to the convalescent, contact and other carriers the vibrios isolated at different times from the same individual showed differences with regard to serological reactions and, to a smaller extent, chemical structure. Here again the suggestion is that some of these changes are, at any rate, due to variations in the vibrio rather than to re-infection, for, in the first place, changes in the chemical structure are less frequent than those associated with serological reaction. Secondly the period during which the changes have taken place are, on some occasions, so short as to render re-infection improbable though not impossible.

Interpretation of pathogenicity in terms of serological and chemical classifications.

This is the crux of the whole problem. Epidemiological data appear to throw some light on the subject.

Serological: It has already been pointed out that, as regards the proportion of severe cases, the cases showing H and O agglutination did not differ significantly from the non-agglutinating cases. Taking the Inaba 'O' positive cases alone, the same result was obtained.

Secondly, of the seven water supplies which yielded Inaba 'O' positive vibrios, five tanks served as sources of drinking water for 1,452 persons and 55 used them for domestic purposes. None of them developed the disease. Does this suggest that the choleragenic role of this type of organism cannot be accepted as proved or that the organism alone is not sufficient to produce the disease?

Chemical: The chemical classification of vibrios corresponds to the source of origin with respect to cases and contacts, though anomalies may exist.

As has already been pointed out the chemical groups are not able to differentiate between epidemic and sporadic cases nor between the clinically severe, moderate and atypical cases.

Statistical study.

This study has two objects in view. One is to evolve quantitative methods of expressing the epidemiological features of the cholera history of the locality under investigation and the other is to devise an efficient method of forecast as the existing ones are not satisfactory.

In regard to the first object certain statistical criteria have been worked out and a description of the south-western portion of Bengal has been completed. A classification of the *thanas* into endemic and non-endemic areas has been carried out and these groups have been further sub-divided into classes based on varying values for the probability of the prevalence of epidemics in them.

The main group of endemic centres lies distributed on either side of the Hooghly river in its lower reaches. There are four more isolated endemic areas in different places.

The distribution of the non-endemic group is more irregular.

There is only one endemic centre which shows very high epidemicity (Jaynagar). It forms part of the main endemic area near the Hooghly. Of the non-endemic group 17·7 per cent. are subject to high or very high epidemicity. A majority of the centres in both groups are characterised by moderate epidemicity, 77·8 per cent. for the endemic group and 79·2 per cent. for the other.

Next contiguous *thanas* have been combined into cholera districts showing similarity of cholera experience and it is now possible to undertake a comparative field study of the endemic and epidemic areas with respect to the various factors relevant to the cholera problem.

The elaboration of a satisfactory method of forecast is of great practical importance in public health work. The subject is an extraordinarily difficult one. New methods have now been evolved which promise good results. These are being tested.

(2) Epidemic Dropsy.

The plan and organisation of the enquiry were described in last year's report. The investigations during the present year fall under three heads, (1) field study, (2) human experiments and (3) research in the laboratory.

Field investigations.

During the year two field investigations were carried out, (1) at Twenty-lines tea garden in Assam and (2) at Jamshedpur. The main epidemiological features of the outbreaks in these localities were the same as those presented in last year's report. A point of special interest was, however, brought out at Jamshedpur where the investigations gave strongly suggestive evidence in support of the 'mustard oil' theory. Jamshedpur has a population of about 100,000 composed of people from practically all the provinces of India and of a small number of non-Indians. One hundred and eighty-five cases occurred in 52 Bengali families and 37 cases in 14 non-Bengali families. The use of a particular brand of mustard oil from a local oil mill, purchased within a limited period of 5 weeks just prior to the commencement of the outbreak, was a feature common to a large majority (nearly 95·5 per cent.) of the affected families. In regard to the remaining 4·5 per cent. there was conflicting evidence in that, while the consumers asserted that they were using this brand of oil, the grocer denied having stocked a supply of that particular brand of oil.

Experimental investigations

Several samples of rice were examined bacteriologically. The results are summarised below:—

(i) commercial formalin was not a reliable disinfectant for the sterilization of the surface of certain varieties of rice grain.

(ii) the surface sterilization of the rice grains could be efficiently carried out by means of mercuric perchloride solution in 1 in 1,000 dilution, acidified with 0·5 per cent. hydrochloric acid.

(iii) the presence of the ' rice bacilli ' in the central or other types of opacities in the rice grain could not be demonstrated if the surface sterilization was efficient.

(iv) the traces of mercuric perchloride left on the surface of the grain in the process of disinfection did not interfere with the growth of the organism when it was artificially introduced into the centre of the grain and the mouth of the opening was sealed.

Attempts made to artificially produce opacities in clear rice grain through storage under suitable conditions of temperature and humidity, after inoculating them with ' rice bacilli ', proved unsuccessful.

Samples of rice were obtained from various districts of Madras Presidency, which were free from epidemic dropsy. Some of these samples showed very high proportions of centrally opaque grains. No spore bearing aerobos could be cultivated from the opaque portions of the grains.

With a view to following the development of an epidemic from its commencement, a semi-isolated community of 36 Bengali families in South Calcutta was kept under observation from September onwards. No cases developed.

In order to test the validity of the contagion theory, cases of epidemic dropsy (about a week after the onset) were made to sleep, under controlled conditions, in close proximity to healthy persons. The disease did not spread.

Feeding experiments were conducted on human volunteers living under strictly controlled conditions with a view to testing the validity of the rice and mustard oil theories.

Twelve healthy persons were divided into 4 batches of three each. They were given special diet as shown below:—

(1) ' healthy ' rice and good mustard oil,

(2) ' healthy ' rice and suspected mustard oil,

(3) ' diseased ' rice and good mustard oil,

(4) ' diseased ' rice and suspected mustard oil.

The ' diseased ' rice was given for a period of six weeks and the suspected oil for only two weeks, as the stock was exhausted. No cases developed.*

Help rendered to outside persons.—There is a growing demand, on the part of research workers, in and outside Calcutta, for the help of the department for the evaluation of their experimental

* The experiment has subsequently been repeated with the samples of mustard oil obtained during the outbreak of epidemic dropsy at Jamshedpur. Through the use of this oil the signs and symptoms of epidemic dropsy have been produced in a number of persons. The results are being submitted for publication.

data. The department assisted the Tuberculosis Association of Bengal in formulating a scheme for the collection of epidemiological data and also trained one of their workers in the methods of recording and tabulating information by the Powers-Samas sorting machine.

In view of the growing volume of requests for help I have made a proposal for the appointment of two computors in order that the senior staff may be partly relieved of heavy arithmetical calculations and thus spared time for higher work.

Acknowledgments.—I have great pleasure in recording that all the members of the department worked loyally and ungrudgingly during the year.

A list of papers published from this Department is given below:—

1. The probable trend of Population Growth in India—K. C. K. E. Raja, *Indian Journal of Medical Research, July 1935.*
2. The Population Problem in India—A. J. H. Russell and K. C. K. E. Raja, *Indian Journal of Medical Research, October 1935.*
3. Duration of life of the sandfly *P. argentipes* under laboratory conditions and other statistical data—K. C. K. E. Raja. It is an appendix to the paper " Bionomics of P. argentipes, Part 1, the duration of life in nature ", by Drs. R. O. A. Smith, S. Muckerjee, K. C. Halder and Jamadar Chiranji Lal in the *Indian Journal of Medical Research, July 1936.*
4. A statistical study of the data of growth in shells of *Trochus niloticus Linn* in Andaman waters—H. Srinivasa Rao and K. C. K. E. Raja—*Records of the Indian Museum, December 1936.*
5. A Forecast of Population in India at the 1941 Census—K. C. K. E. Raja, *Indian Journal of Medical Research, April 1937.*
6. Some experiments with an automatic mosquito-catching machine: The Entoray—R. Senior White, R. B. Lal, A. K. Adhikari and Satya Swaroop, *Records of the Malaria Survey of India, December 1936.*
7. On the application of trigonometrical functions to the calculus of finite differences—K. C. Basak, Sankhya, the *Indian Journal of Statistics, December 1936.*
8. Fairs and Festivals in India—R. B. Lal, *Indian Medical Gazette, February 1937.*

REPORT OF THE PROFESSOR OF BIOCHEMISTRY AND NUTRITION.

(Dr. H. Ellis C. Willson, M.B., Ch.B., D.Sc.)

The work of the department during the year has been devoted mainly to investigations on nutrition—a continuation of the policy outlined in the previous years reports. A greater use of the facilities for clinical investigation in the School of Tropical Medicine has been made in connection with diseases of a nutritional or metabolic nature.

Physical and Nutritional Survey.—The examination of some 4,500 children has been completed in Calcutta and of 1,250 in Ferozepore (Punjab). The data obtained in Calcutta show that the poorer classes are probably suffering from a deficiency in the quantity and quality of protein rather than from any lack of specific vitamin. As the work proceeded the scope of the inquiry widened. As regards the value of the A. C. H. index of nutrition, this has, in its present form, been found to be of no value in selecting children of poor physique (underweight) in Calcutta. It showed no correlation with the incidence of caries or enlarged tonsils. The index however has shown a certain correlation with children assessed clinically as of poor physique in the Punjab. The incidence of malocclusion of teeth and the measurement of hand grip by the dynamometer are being taken up. The figures obtained so far indicate that the poorer classes have a diminished grip compared with those better off.

Vitamin assay, B_1, B_6 and Flavin.—The B_1 assay of some 80 foodstuffs has been completed and the B_6 and flavin components are now being taken up with the aid of a grant from the Indian Research Fund Association. Flavin is being estimated both chemically and biologically in a number of foods with a view to working out a relatively simple and rapid means of determining the contents of this factor in Indian foodstuffs. Both colorimetric and fluorescent methods are being tried out.

As regards vitamin B_6 the biological method is the only one at our disposal at present.

The absorption and Metabolism of Carotene.—The absorption of carotene on different diets has been investigated both in animals and in man. The data on animals show that carotene is better absorbed when fed in the natural state (spinach) or dissolved in oil than when given in a watery suspension. The absorption of carotene does not appear to be affected by adding bile salts or extra meat to the diet to promote a flow of bile but the evidence obtained from an examination of the liver showed that its transformation into vitamin A may have been more efficient under those conditions. In the human subject the absorption of carotene fed as spinach was better on a fat diet than on one poor in this foodstuff. There was evidence that the active *beta* carotene was selectively absorbed by the intestine. The absorption of vitamin A by the human subject appears to be complete as judged by the absence of a positive test on the faeces. The significance of these findings for India where carotene is the only source of

vitamin A for many needs no stressing. The importance of fat in promoting the absorption of carotene and possibly meat in effecting its transformation into vitamin A should be a guide to those interested in practical nutrition not to consider any one food or vitamin to the exclusion of the rest of the diet. Work is at present in progress on the mechanism and site of transformation of carotene into vitamin A in the organism.

Bisulphite Binding Power of the Blood.—The bisulphite binding power (B. B. P.) of the blood (pyruvic acid) has been shown to be increased in cases of *beri-beri* in China and in experimental *beri-beri* in animals. During the year, with a view to elucidating the nature of epidemic dropsy in Bengal, the B. B. P. of the blood of normal individual and others suffering from epidemic dropsy, the dicerent anaemias and malaria, etc., have been investigated. The data obtained so far show that the B. B. P. is considerably (100 per cent.) increased in epidemic dropsy, chronic dysentery and anaemias as compared to normal subjects both Indian and European. In no case were the values so high as those found in China in patients with real *beri-beri*. Data from cases of wet *beri-beri* would be of interest.

Vitamin B_1 metabolism in human subjects.—The excretion of vitamin B_1 in the urine of subjects on fixed diets is being investigated with a view to finding the general saturation of normal and diseased individuals in this food factor. The method and results should be of value in investigating epidemic dropsy and some of the anaemias which appear to be associated with a deficiency of the B group of vitamins.

Experimental production of cataract.—The production of cataract on diets deficient in the B_2 factors has been investigated but so far the factor concerned has not been discovered. The condition was produced in about 30 per cent. of animals and appears to be associated with some factor in the B group other than B_6 and flavin.

Anaemia.—An investigation into the proportion of the two types of haemoglobin (alkali resistant and alkali labile) in anaemic patients is being taken up.

Basal Metabolism.—Data on the basal metabolism of children in Calcutta are being collected with a view to fixing dietary standards and calories requirements for India. The data obtained so far do not appear to indicate that the energy output is less than that found in Europe.

In January 1935 I was appointed a member of a Committee to investigate maternal mortality in Delhi. In the same year I was appointed a member of the Nutritional Advisory Committee which met at Simla. A general scheme of work was drawn up with the view of making a nutritional survey in India including the examination of children, diet surveys, food analysis and available supplies of special foods which India appears to be deficient in.

The usual course of lectures was given to the D. P. H. students and a Special three months course to one student. One student for the D.Sc. (public health, special subject nutrition) has just completed and handed in to the University his thesis on the nutritional survey of children in Calcutta.

Dr. Durga Das Mitra who was taking the special course for D.Sc. in public health was awarded a scholarship by the Government of Bengal to prosecute his work on the nutritional and physical examination of children.

The following papers on the work of the department have been published in the past year:—

A diet survey of certain families and institutions in Calcutta. *Ind. Jl. Med. Research (1936), Vol. 24, P. 161.*

Further observations on the metabolism of carotene. *Ind. Jl. Med. Research (1936), Vol. 24, P. 399.*

The carotene contents of some Bengal foodstuffs. *Ind. Jl. Med. Research (1937), Vol. 24, P. 801.*

The Ash Calcium and phosphorus content of some common Bengal foodstuffs. *Ind. Jl. Med. Research (1937), Vol. 24, P. 797.*

Studies on the absorption of carotene and vitamin A in the human subject. *Ind. Jl. Med. Research (1937), Vol. 24, P. 807.*

Nutritional survey of school children in Calcutta and the Punjab by means of clinical observations A. C. H. Index and other measurements. *Ind. Jl. Med. Research (1937), Vol. 24, P. 817.*

The vitamin B_1 content of some common vegetables, cereals and fruits. *Ind. Jl. Med. Research (1937), Vol. 24, P. 813.*

REPORT OF THE PROFESSOR OF MALARIOLOGY AND RURAL HYGIENE.

(Dr. K. V. Krishnan, M.B.B.S., M.R.C.P., D.B., D.Sc.)

A perusal of this report will show that during the year under review the activities of the department increased both with regard to teaching and research and that a large volume of interesting work was got through. The malaria section of the department is now well organised but it is felt that with the present staff it is not possible to expand the activities of the tuberculosis section any further. There is a definite demand for a three months advanced course in public health aspect of tuberculosis which cannot be met with our present resources. Proposals for additional staff have been submitted. The additional staff if and when sanctioned will also enable us to undertake researches on some of the important problems relating to tuberculosis in this country.

Staff.—I was away during the vacation and for a month after vacation. During this period Dr. B. Ghosh, the Assistant Professor carried on the routine work of the department in a satisfactory manner. Dr. P. N. Bose, the Research Assistant is now in charge of the Field Malaria Centre which has been organised on a more or less permanent basis. His services therefore, are not available for the tuberculosis section of the department.

Teaching.—As usual lectures and demonstrations on malariology, venereal diseases, tuberculosis and other communicable diseases were given to the D. P. H. and D. P. H. & Hy. students. At the request of the Organising Secretary, King George's Thanks-giving (Anti-tuberculosis) Fund special lectures on the bacteriological and public health aspects of tuberculosis were delivered to the post-graduate students undergoing training in tuberculosis under the auspices of that Organisation. Dr. Parayan Prosad. L.M.S., School Medical Officer, Patna Division, who was taking the Composite course received a course of special lectures and practical instructions in malariology, venereal diseases and tuberculosis. In addition to these, this year for the first time, a three month's Special Course in malariology was organised and three students, Dr. Ahibhusan Roy, M.B., Dr. Kali Prosad Saxena, M.B.B.S., D.P.H., and Dr. Prafulla Kumar Roy, M.B., underwent training. They were given an intensive theoretical and practical training in malariology including protozoology, entomology, haemotology, epidemiology and statistics. Special emphasis was laid on methods of survey and control. This course took up practically the whole time of the staff for a period of three months.

Research.—The following researches were conducted during the year:—

Why A. culicifacies does not carry malaria in Bengal.

A. culicifacies is generally recognised as the best malaria carrying species in India. According to certain observations this is not so in eastern areas. Our own experience is in conformity with this view as a large number of insects dissected by us were found negative. There are two possible explanations of this anomaly, *viz.*, (*a*) *A. culicifacies* as

seen in Bengal is a different race from what occurs elsewhere. (*b*) Its seasonal incidence in Bengal is restricted to a part of the year when environmental and other conditions are unfavourable for transmission of malaria.

Experiments with adult mosquitoes obtained from Singhbhum and from Abujhati in Bengal showed that both batches were capable of getting infected to the same extent when fed on persons carrying gametocytes. The development of the parasites proceeded to the sporozoite stage in either case. It would therefore, appear that the insects met with in Bengal are of the same race as those found elsewhere in India where they carry malaria.

Observations at the Field Malaria Station at Abujhati, last year made it clear that the seasonal incidence of this species of mosquitoes is very restricted. The larvae appeared in canal water and in other breeding places into which this water was let in, during January. They were found in a number of breeding places up to March. Adult insects were also caught from houses near the breeding places during these months. After March neither the larvae nor the adults could be found. This restricted seasonal distribution of *A. culicifacies* in Bengal seems to provide the explanation of the problem. During late winter and early spring when this species appears in Bengal, the gametocyte carrier rate is low and conditions of temperature and humidity are unfavourable for the completion of the sexual cycle in the mosquito.

The reasons why this insect is not able to establish itself permanently in Bengal and to breed throughout the year are not quite clear. It was, however, found that eggs of *A. culicifacies* imported from Singbhum during the malaria season in Bengal (July to December) could be successfully bred out in clear water above a layer of sand but under conditions prevailing in Bengal at the time, namely, muddy water with certain type of aquatic vegetation, breeding was very difficult. It would appear that the temperature conditions as well as the quality of the water available in breeding places were responsible for this inhibitory effect. Thus the insignificant part which *A. culicifacies* plays in the spread of malaria in Bengal may be ascribed to the non-correspondence of the periods of the incidence of maximum gametocyte rate and the *A. culicifacies* prevalence rather than the possible differences in the race of these mosquitoes in Bengal and elsewhere. This work is still in progress and the results will be published when the work is completed.

Laboratory Studies on the Entoray.—The Entoray is an apparatus recently introduced in the market. It consists among other things of two important parts, namely, (1) a quartz mercury vapour lamp and (2) a suction pump. The lamp emits a powerful violet blue light and this is said to attract large number of mosquitoes and other insects towards the apparatus, and the suction pump draws with the current of air the insects that come within its range. It is claimed by the inventor that use of this apparatus will materially reduce mosquito incidence and consequently malaria and other mosquito-borne diseases. At the request of the manufacturers we experimented in our laboratory with the Entoray lamp (without the suction apparatus) to find out (1) whether the lamp attracted carrier and non-carrier anopheles mosquitoes commonly prevalent in the towns and rural areas of Bengal, under

laboratory conditions; (2) if so what was the degree of such attraction; (3) whether the Entoray lamp alone was capable of attracting these mosquitoes or whether any electric lamp of similar colour would also attract them to the same extent; (4) whether the light from the Entoray lamp containing as it did ultraviolet rays, had any lethal effect on mosquitoes that came under its influence. Mosquitoes of three species, *e.g.*, *A. subpictus*, *A. fuliginosus* and *A. stephensi* were used in the experiments. Both males and females, fed and unfed, laboratory bred and wild ones were utilised. From the results obtained the following conclusions were arrived at: (1) The Entoray lamp does attract to a certain extent carrier and non-carrier species of anopheles used in the experiment. (2) At a distance of 14 ft. about 50 per cent. of the total number exposed were attracted. (3) A powerful electric lamp used as control also attracted nearly the same number of mosquitoes. (4) The radiations from the lamp had no lethal effect on mosquitoes exposed to them for a period of 40 to 60 minutes at distances over 3 ft.

Stages in the life cycle of the Malarial Parasites.—The observation of Schauddin that the sporozoites directly enter erythrocytes has never been confirmed. Recently Missiroli as a result of his experiments has suggested that the sporozoites as such do not penetrate but probably they break up into small fragments which enter the red cells.

Sporozoites obtained from the salivary glands of *A. stephensi* infected with *P. falciparum* were mixed with citrated human blood under aseptic conditions and the changes in the sporozoites taking place were observed on the warm stage by the dark ground illumination. In none of the cases studied were the sporozoites seen entering the red cells. Many of them were close to and in apposition with the red cells, but they did not enter them. At the end of 2 to 3 hours it was observed that the majority of sporozoites were smaller in size than they were in the beginning; whether these were viable young forms or degenerating or disintegrating forms it is difficult to say. On staining these, however, it was noted that their size was reduced to one-half or one-quarter of the original. Although division bands appeared across some of the long form the actual division of the sporozoites under the microscope was not seen.

Epidemiological Studies in Human Blackwater Fever.—So far an epidemiological survey of blackwater fever has been conducted in 50 out of a total of about 155 tea-gardens situated in the Jalpaiguri Duars. The following facts have come out of the survey:—(1) The population consists of *Paharias* and *Madesias* (about 98 per cent.) and Chinese, Bengalees and Europeans (about 2 per cent.). (2) A total of 132 cases occurred in these 50 gardens between 1930 and 1936 both years inclusive and of these 31 occurred in 1936. The distribution of the 31 cases in the different groups of population was as follows:—

Group.	Population.	Cases of Blackwater fever.
Europeans	112	1
Bengalees	811	25
Chinese	49	2
Paharias	10,404	2
Madesias	43,940	1

(3) The case mortality was about 20 per cent. All the deaths were amongst the Bengalees. (4) A study of the age incidence showed that over 70 per cent. of cases were in adults above 20 years and 15 per cent. in children below 10 years. The youngest patient was 2 years and 6 months old. The peculiar age constitution of the cooly population has to be borne in mind in interpreting these results. (5) About 80 per cent. of the cases occurred amongst those who had lived for over 3 years in the locality. (6) 80 per cent. cases occurred between May and September. (7) Out of the 50 gardens surveyed 8 were found to be free from blackwater fever; in these no case had occurred within the past six years. In these gardens neither the nature of the population nor the intensity or type of malaria were different from those of the neighbouring gardens noted for blackwater fever cases. Studies are in progress to find out the factors that are responsible for the absence of blackwater fever in these gardens. Attempts are also being made to find an explanation for the high incidence and mortality amongst the Bengalees. The explanation does not appear to lie in greater incidence of malaria in this community as the Bengalees suffer from malaria no more than the other communities do. Undoubtedly differences in habits, diet, etc., will have to be taken into account before a satisfactory explanation can be arrived at. The importance of these host factors is suggested by our laboratory studies on monkey haemoglobinuria. The incidence of haemoglobinuria in these animals is determined to a large extent by the type of response put forth by the host to malarial infection. The peculiar sets of conditions of a cytological and biochemical nature which are seen just prior to the onset of haemoglobinuria are essentially determined by the reserves at the command of the host and by his ability to mobilise certain fundamental constituents of blood in a specific way. This, in turn, is determined by the previous history of the host, his race, diet, habits, health, etc., which may be termed " the host factor ". This appears to us to be the most important factor in the aetiology of blackwater fever.

Biochemical Studies in Human Blackwater fever cases. —Samples of blood from 8 human cases of blackwater fever were examined during the year. All samples were obtained after haemoglobinuria had set in. The results are in keeping with the results obtained in monkey haemoglobinuria. The agencies at work in both these conditions for causing a predisposition to sudden severe haemolysis appear to be allied. The total cholesterol varied from about 102 to 135 mg. per 100 c.c. of blood. These figures are lower than normal values which are 150 to 190 mg. per 100 c.c. of blood. Organic phosphorus varied from 7·4 to 18·6 mg. per 100 c.c. of blood. The average of these values on the whole are higher than the normal, namely, 10 to 12 mg. per 100 c.c. of blood. In monkeys also high values for organic phosphorus as lecithin and low values for free cholesterol were observed immediately after the attack of haemoglobinuria. These changes indicate that there is not only a derangement of the fat metabolism but also prior to haemolysis, there is an upset in the lecithin-free-cholesterol ratio. It is this ratio that seems to be of importance in determining the extent and the duration of haemolysis. This view is further corroborated by the results obtained a few days after the onset of the condition. The mobilisation of free cholesterol that occurs in such cases and its association with recovery is very striking. The values for free-cholesterol are far above

the normal values and constitute more than 65 per cent. of total cholesterol. Although the organic phosphorus remains at a high value for a time the excess of free-cholesterol brings down the above ratio to normal and recovery from haemoglobinuria takes place. In course of time both organic phosphorus and cholesterol tend to settle down to the normal values.

Malarial Haemoglobinuria in Monkeys.—The biochemical studies on haemoglobinuric monkeys commenced in 1935 were completed this year. The results obtained in the splenectomised and non-splenectomised groups and in the haemoglobinuric and non-haemoglobinuric groups have been analysed. In all 1,689 biochemical examinations on samples of blood of 37 monkeys have been completed. Of these 839 were performed during the current year. The results indicate that a marked upset in the carbohydrate and lipoid metabolisms precedes the onset of haemoglobinuria and that possibly a haemolysin of the nature of an unsaturated fatty acid is produced which acts effectively when conditions are favourable, *i.e.*, when *free-cholesterol* is low.

The nature of biochemical changes observed prior to the onset of haemoglobinuria suggested that these changes may be the result of a profound injury to the liver. Histological examinations of liver and adrenals obtained from *post-mortem* of haemoglobinuric and non-haemoglobinuric monkeys were, therefore, conducted. Fatty degeneration and cloudy swelling of the liver together with degenerative changes in *zona faciculata* of the adrenal cortex were noted to be a constant feature in all cases. These changes were more pronounced in the haemoglobinuric monkeys. Some of the latter also showed areas of focal necrosis in the liver. These findings not only confirm the results obtained by Dadgeon and Clarke in *one case* of human blackwater fever, but they also explain the biochemical alterations recorded above. Furthermore they indicate the lines of treatment that may be profitably adopted.

Attempts were, therefore, made to treat the haemoglobinuric monkeys by correcting the observed biochemical and pathological changes or by preventing their occurrence. Treatments on the following lines were tried:—(1) Intravenous injections of glucose and insulin to correct if possible the deranged carbohydrate metabolism. (2) Injections of a colloidal solution of cholesterol to increase the free cholesterol content and prevent haemolysis. (3) Injection of compounds like glutathione which are known to bring about oxidation of fatty acids both *in vivo* and *in vitro*. (4) Injections of choline hydrochloride and choline phosphoric ester (synthesised in our laboratory). This line of treatment was suggested by the fact that choline is present in the spleen and that splenectomised monkeys show a greater incidence of haemoglobinuria. It is possible, therefore, that deficiency in choline in splenectomised animals plays a part in the causation of haemoglobinuria. (5) Injection of cortin and ascorbic acid to make up for the degenerative changes observed in the adrenal cortex. So far, we have obtained encouraging results with a combination of glucose, ascorbic acid and cortin. Of these cortin appears to be the most important. The adrenal gland in addition to being the seat of two important hormones is known to be directly concerned with the control of substances like cholesterol, glutathione and ascorbic acid. Although the treatment has so far

been tried on four monkeys only, the results were uniformly satisfactory in as much as the treatment helped the animals to *temporarily* overcome the haemoglobinuria in all cases. The cortin employed in some experiments was the commercial preparation which is not very potent—1 c.c., containing only 1/10 grm. of cortical tissue. Attempts were, therefore, make to prepare a more potent extract by the method of Swingle and Pfiffner. It is hoped that more definite results will be obtained when such a preparation is available, because our results suggest that endocrine disfunction plays an important part in the causation of haemoglobinuria. It is at present difficult to say which particular gland is the seat of dislocation. It would in fact appear worth while investigating the action of endocrines generally, in the treatment of blackwater fever. It is interesting to mention here that independent observations of a similar nature from foreign laboratories have just been published. Armentano has successfully treated one case of paroxysmal haemoglobinuria with ascorbic acid. A detailed and systematised programme of investigation regarding the rôle of endocrines in blackwater fever is now in progress and it is hoped that it would yield valuable results.

Cholesterol Changes in Kala-azar.—The changes taking place in blood cholesterol in malaria and in tuberculosis during the progress of infection and recovery were investigated last year. Similar studies were made this year on kala-azar cases before and after treatment. The cases were classified under four headings, namely, (*a*) advanced, (*b*) moderate, (*c*) early and (*d*) non-kala-azar cases, *i.e.*, cases resembling kala-azar clinically. The results showed that in kala-azar as in the other diseases there is a gradual depletion of cholesterol with the progress of the disease. This lowering of cholesterol was, however, also noted in the advanced non-kala-azar cases. The fall in cholesterol was chiefly due to a drop in *ester cholesterol*. The point of special interest, however, is that while in malaria there is a lowering of *free cholesterol* and a rise in ester cholesterol during the stage of intense parasitisation, in kala-azar and certain other diseases ester cholesterol is low. Unlike malaria ester cholesterol drops with the progress of the disease and rises again on treatment and recovery. After treatment and cure the value of ester cholesterol returns to normal. It is possible that one of the reasons why kala-azar patients with latent malaria frequently suffer from relapse of the disease after treatment for kala-azar, is the rise in ester cholesterol.

The Rôle of Endocrines in Resistance to Tuberculosis.—The possibilities of stimulation of the defence mechanism of the body by the endocrines and the vitamins have been suggested by various observers from time to time. The detoxicating action of substances like vitamin C are also well-known. Our own findings with regard to the beneficial effect of vitamin C and cortin in malaria and haemoglobinuria are also suggestive. The rôle of these substances in increasing the resistance to tuberculosis is, however, very little understood. We, therefore, decided to find out if and how they would modify the course of tuberculosis in experimental animals. Animal experiments on these lines were, therefore, undertaken. These experiments have just been commenced and sufficient progress has not been made to warrant any pronouncement at this stage.

Incidence of Syphilis in Various Groups of Population.—In last year's report the results of investigation on the incidence of syphilis in three groups of population namely the Indian military population, the jail population and the industrial population, were presented. This year we have examined other three classes of population namely, University students, the unskilled labourers and the agriculturists. The results show that the incidence varies greatly in these groups being very low amongst the students, the agriculturists (less than 5 per cent.) and relatively high amongst the labourers (10 per cent.). This work is still in progress and will be reported when it is complete.

In conducting the researches we sought and received help and co-operation from many organisations and individuals. In this connection we are specially indebted to—Col. R. N. Chopra, Director, Calcutta School of Tropical Medicine. Dr. L. E. Napier, Professor of Tropical Medicine, Captain Lakshmanan, I.M.S., Port Health Officer; Dr. R. B. Khambata and Dr. S. N. Sur, Directors of Public Health, Bengal; Mr. Vitaltei Menasche, the inventor of the Entoray, Professor K. S. Krishnan, Indian Association for the Cultivation of Science; Mr. Shyama Prosad Mookerjee, Vice-Chancellor, Calcutta University; the Superintendent, Bengal Government Press; the Shipping Master, Government of Bengal.

Papers published during the year:

Spontaneous tuberculosis in laboratory monkeys. *Ind. Jour. Med. Res., Vol. 23, Jan. 1936, p. 721.*

Cholesterol changes in Monkey malaria and haemoglobinuria. *Records Mal. Surv. of India. Vol. 6, March 1936.*

The aetiology of blackwater fever. *Ind. Med. Gaz., Vol. LXXI, No. 3, March 1936.*

REPORT OF THE PROFESSOR OF MATERNITY AND CHILD WELFARE, 1936.

(Dr. M. I. Neal, M.D., W.M.S.)

Maintenance.—The Maternity and Child Welfare Section of the All-India Institute of Hygiene has been maintained as in previous years by the Governing Body of the Women's Medical Service. A member of the Service has been lent to act as Professor of Maternity and Child Welfare and a grant has been provided for the running expenses of a skeleton Section and towards the maintenance of the Welfare Centre. Additional financial assistance for the Welfare Centre has been received during the year from the Calcutta Health Week Committee, the Corporation of Calcutta and the Raghumall Charity Trust. A grant from the Indian Research Fund Association for a statistical enquiry into the causes of maternal mortality in Calcutta was sanctioned for the year 1936-37.

Teaching.—*D. M. C. W. Course:* There were no students taking the course for the Diploma of Maternity and Child Welfare in 1935-36. One student deputed from the W. M. S. Training Reserve began the course in October 1936. Practical difficulties have arisen regarding accommodation for D. M. C. W. students during the midwifery course which has been arranged with the Eden Hospital. It is felt that the practical experience in venereal diseases and hospital antenatal work available at present in Calcutta is inadequate for this post-graduate course. With the permission of Lt.-Col. Murray, I.M.S., the D. M. C. W. student attended the Presidency General Hospital where Dr. Coltman gave ten lecture demonstrations on diseases of children. Dr. Coltman has for three years given these lectures honorarily and we are greatly indebted to him for the trouble he has taken to make them interesting and valuable.

D. P. H. Course: Ten lectures and four demonstrations in Maternity and Child Welfare and five lectures in School Hygiene and Medical Inspection of Schools were given to students taking the D. P. H. course in 1936.

Field Work.—1. *Welfare Centre (Calcutta Health Week Clinic):* This Centre has been carried on as part of the Maternity and Child Welfare Section for the purposes of teaching and demonstration, to provide data for research and as an experimental effort in intensive maternity and child welfare work in a restricted field.

The whole building of No. 34-A, Ratu Sircar Lane, has been rented since September 1936. Building alterations were made, and the rooms are now convenient for clinic work. Glass windows for the display of models and posters have been fitted and these with the exhibits shown are to form a memorial to the late Rai Bahadur K. P. Rai. The compound which we are allowed to use rent-free by the generosity of Rai Bahadur Rem Dev Chokhany continues to be of the greatest value to the mothers and children and to the members of the Centre

staff. A report of the Welfare Centre is published separately, the following are some of the figures:—

Antenatal, Infant and Toddler Clinics were carried on as in previous years. Postnatal cards were introduced into use. The Nursery School has been continued in the charge of a new teacher appointed in August.

During the year 1936, 389 antenatal cases of whom 54 per cent. attended the antenatal clinic were under care. There were 215 Centre antenatal cases delivered during the year with one maternal death, a maternal mortality of 4·6 per 1,000 births. The maternal mortality rate in the whole "district" (Half Ward 8) was 28·6 per 1,000 births (total of registered and other births found by house visiting).

There was 436 infants put on cards during 1936. Forty-two per cent. of these attended the Centre, the others received home visits. The mortality of infants on cards was 121 per 1,000. This is higher than in the previous year but the high rate is largely due to a severe epidemic of small-pox. The infantile mortality in the "district" was 196·4 per 1,000 live births. The total clinic attendances of antenatal cases, infants and toddlers during the year was 5,913, an average weekly attendance of 113. A total of 5,775 home visits were paid during the year, an average of 240 visits per month by each health visitor.

The following figures show the results of small-pox vaccination in Centre children during the epidemic which occurred in the first quarter of 1936.

During the period January to March 1936, there were 604 infants and children under five years of age on clinic "cards".

Four hundred and thirty-four of these were successfully vaccinated before or during the epidemic and 170 were not vaccinated.

The results of vaccination were as follows:—

	Clinic children.	Cases of small-pox.	Cured.	Died.
Vaccinated . . .	424	3	3	*Nil.*
Not vaccinated . . .	170	42	25	17
Vaccinated less than a week before developing the disease	10	10	3	7

Case incidence amongst the vaccinated children—0·7 per cent.

Case incidence amongst the unvaccinated children—24·7 per cent.

Mortality amongst the vaccinated children—*Nil.*

Mortality amongst the unvaccinated children—38·5 per cent. cases.

A mortality of 70 per cent. occurred in 10 cases of children vaccinated less than a week before developing the disease.

2. *Clive Jute Mill Maternity and Child Welfare Centre:* This welfare centre is provided by the Mill authorities for the benefit of the women workers. A Crêche for the children of workers and a maternity service are the main features of the work and make possible the collection of data regarding conditions amongst an industrial population and provide useful material for teaching and demonstration. A nutrition experiment is being carried out on the Crêche children. The failure to gain in weight which often occurs in the transition period from breast to ordinary diet in Indian children was found to be very marked

in the children of these working mothers whose milk in some cases begins to diminish as early as the 4th month. Dr. Ellis C. Willson, was kind enough to arrange for the analysis of samples of breast milk from working and non-working mothers and the conclusion was reached that the defect was one of quantity and not of quality of the milk. Steps have been taken to supplement the food of infants and toddlers at the Crèche by giving an average of 350 calories daily to each child mainly in the form of such food constituents as the children do not get at home.

Medical reports of the work of the Centres are published separately. Copies can be obtained on application.

Research.—*Maternal Mortality Enquiry:* A grant of Rs. 7,500 was sanctioned in 1936 for a statistical enquiry into the causes of maternal mortality in Calcutta. Two women doctors to act as research assistants were required and proved difficult to obtain. We are further indebted to the Chief Medical Officer, Women's Medical Service, for the loan of the services of Miss Ivy Massick, M.R.C.P. and later of Miss S. Pandit, M.B.B.S. Miss Freni Shaw, M.B.B.S. was appointed to the second post.

The enquiry covers the area under control of the Health Officer, Calcutta Corporation. The intention is to investigate every female death associated with pregnancy, childbirth and the puerperium for the period of one year. We are grateful to Dr. L. M. Biswas, Health Officer, Calcutta Corporation for his co-operation in allowing duplicate registration cards to be available for our use in the case of every female death between the ages of 10 and 50 years. On these duplicate cards questions are asked regarding the existence of pregnancy, labour or abortion and the answers to these questions are filled in by the sub-registrars at the burning ghats or burial grounds. All cases of suspected and definite maternal deaths are investigated by visits to the homes and to the attendant at delivery or to the hospital.

It is not an easy task to secure accurate information regarding women who have died, and the research assistants are to be congratulated on the successful way in which they have gained the co-operation of those they visited. We have reason to be very grateful also to those doctors and hospitals in Calcutta whose records of cases have been so kindly put at our disposal.

Between June 15th and December 31st, 595 deaths were investigated, of which 505 proved to be maternal deaths. The first 300 cases followed up were analysed and the following is a summary of some of the findings:—

Associated diseases accounted for 16·6 per cent. and childbearing was directly responsible for 80·4 per cent. (unknown 3 per cent.).

Sepsis caused the largest number of deaths in the childbearing group namely, 79 deaths or 32·7 per cent. Fifty-nine per cent. of these followed normal labour of which 47 per cent. were delivered by dais. Anaemia appeared to be a contributing factor in 41 per cent. of sepsis deaths following normal delivery. Toxaemias were responsible for 61 deaths (25·3 per cent.) in the childbearing group (eclampsia 49·2 per cent.). Primigravidae formed 69 per cent. of the eclampsia cases. Anaemia *per se* caused death in 45 (18·6 per cent.) cases in the childbearing group and was present and probably contributed to the fatal

issue in 99 (33 per cent.) others in the whole series of 300 cases. Information regarding the forms of anaemia present has not been possible to obtain. Haemorrhage, ante and post-partum caused 34 (14·2 per cent.) deaths in the childbearing group. Shock and Accidents of Labour caused 13 or 5·4 per cent. deaths. Disproportion and difficult labour is uncommon in Calcutta.

Prenatal Care was given in only 13·7 per cent. of the deaths due to childbearing for which this data was forthcoming. A "primary avoidable factor" was present in 94·2 per cent. of deaths due directly to childbearing.

Publications:

Report on the A. M. W. I. Returns from Women's Hospitals in India for 1935. *A. M. W. I. Journal, August 1936.*

Results of Vaccination in a Welfare Centre, Calcutta, for 1936. *A. M. W. I. Journal, August 1936.*

REPORT OF THE CHOLERA CARRIER AND STRUCTURAL ENQUIRY.

(Dr. R. W. Linton.)

The work of this Enquiry has continued to deal with the bacteriology of cholera, with especial emphasis on the basic structures of the vibrios. As in previous reports, the work may be considered under several headings, but it is again emphasized that these are simply convenient divisions of what is essentially a single problem, that is, the nature of the vibrio.

Variation.—In the report for 1935 an example of a common type of variation was given. In brief, it consisted of the appearance in a strain having a given polysaccharide, of a second polysaccharide, and the separation of two types of colonies in the strain, one having the original polysaccharide in pure form and the other the new polysaccharide, also in pure form. It was stated that such changes occurred regularly, and during the present year they have also been found whenever they were looked for. The source of such a change was of great interest, and the problem was put in the form of a question: "Is the change a mutation in the sense that one type of chemical structure has given rise to another, or was the original strain itself mixed, but with one of the organisms in such a minority that it could not be picked out by analysis?" We have now sought to solve this problem by using strains descended from single cells, which would contain but one of the polysaccharides. It has become evident that variations in chemical structure also occur in cultures of this kind. That is, the organisms originally present and descended from a single cell are capable of giving rise during the multitudinous divisions which they undergo to organisms having another type of polysaccharide. In addition they will also form more than one type of protein. For example, starting with a single cell culture having a given protein and polysaccharide, it is possible to induce variations which will yield organisms having a protein and polysaccharide of entirely different type, and in this way the original strain becomes two strains, each having distinct chemical structure. At the same time the serological, biochemical and metabolic characteristics of the variant differ from those of the original and resemble those of the new group into which the variant now falls. These findings appear to establish a chemical basis for bacterial variation, and at the same time they negative the contention of some bacteriologists that the positive transformation of vibrios does not occur. They also show that at least a part of the variations which are so common among the vibrios are due to spontaneous changes in thier chemical structure.

It is of interest to note that while the vibrios vary in chemical composition, they always remain within the framework found in our previous studies, *i.e.*, the framework of two proteins and three polysaccharides. Within this framework the powers of variation and synthesis are considerable, but they appear incapable of giving rise to

any chemical constituents outside of it. The conception is that of a strictly limited capacity for transformation.

Protein analysis.—The work of the proteins of the vibrios has now covered the following points:—Elementary structure, nitrogen distribution, racemization, isolation of the amino-acid constituents from racemized proteins, absorption spectra, and nucleic acid analysis. The detailed results have been published in a series of six papers, and some of this work has formed the basis for the award of the Doctor of Science degree to B. N. Mitra, Esq., of this Inquiry by the University of Dacca. The racemization method has become a routine for the differentiation of proteins I and II, and has been applied to well over 100 strains.

Attempts to use the two proteins for serological work has met with poor results. In the form in which they can be used for racemization, they are unsuitable for serological work, because they show a marked tendency to cross-react. Such cross-reactions might be expected from the work of Mitra, who has shown that the two differ only in respect to the position of a few amino acids. It is expected that in the future a further attempt will be made to do serological work with the isolated proteins, but it will probably be necessary to fractionate them in order to obtain the more specific portions which they undoubtedly possess, as we have already shown in the case of the polysaccharides.

Polysaccharide analysis.—A thorough study is now being carried out on the polysaccharides of the vibrios, and an immediate result has been to obtain fractions of high reactivity and specificity. An attempt is also being made to obtain not only highly purified and reactive fractions, but also to obtain all of the serologically active polysaccharide material from the vibrio. The latter is a somewhat difficult procedure, since some of this constituent is very strongly bound into the structure of the organisms.

These fractions are being increasingly used in precipitin tests, which are much more delicate and specific than the agglutination reactions, and it is expected that a serological basis for vibrio differentiation will be built up on the basis of these tests. The relationship between this basis and the purely chemical basis remains to be seen, and it will be interesting to see if the classification based on chemical analysis, which correlates well with the epidemiology, will be the same as that revealed by the serology of these new fractions.

Metabolism.—This technique has now been applied to over 300 vibrio strains. In about 100 of these the chemical structure was also known, and a good correlation between the type of metabolism and the chemical classification was found. Such a result gives us considerable confidence that the 220 strains classified into six groups on metabolism alone are rightly grouped, and this confidence is further strengthened by the observation that metabolism as well as chemical structure is correlative with source. Chemical groups I, II and VI contain vibrios from cholera cases and cholera contacts. Their metabolism is relatively high, and they possess protein I. Chemical groups IV and V contain vibrios from carriers both in India and El Tor. Their metabolism is intermediate, and they contain protein II. Chemical group III contains

the water vibrios, which have a relatively low metabolism, and they also have protein II, although a different polysaccharide from groups IV and V. When organisms change their chemical structure in the course of variation, their metabolism also changes and becomes the same as that of the new group to which they now belong.

It has been pointed out in the first part of this report that variations from one chemical group to another occur in the laboratory, and it is of the greatest importance for future work to show whether such variations in chemical structure, in metabolism, and presumably also in pathogenicity can occur in the field. Such studies will answer the vexed question of whether cholera cases arise only from previous cases and from contacts with these cases, or whether the chronic carriers of groups IV and V can on occassion start epidemics. There is no evidence as yet for dogmatically shutting out the second possibility. Transformation is a fact of such frequent observation in the laboratory that it would not be surprising to find that it also occurred in the field. The agglutination reaction will be of less help in such a study than the chemical and metabolic analysis.

The effect of heat on the vibrios.—The study was undertaken because of the use of heat in destroying the " H " antigens of the vibrios for their use in modern serological reactions. The data obtained suggested that the destruction of " H " antigen by heat was a complex phenomenon involving first a rapid change in the surface of the organism, which is reflected in the removal of amino-nitrogen and in increased surface potential, and second by a series of slower and more progressive changes which alter the structure of the vibrio but do not further affect its surface potential. The first change destroys the " H " antigen in the sense that the heated organisms with their higher surface *charges have lessened agglutinability. The second series* of changes destroys the " H " antigen in the sense that the chemical structure is so altered that antiserum against the heated vibrios has now a new specificity and a new range of reactivity. This latter change shows no sign of ending even after four hours' heating, and would presumably continue until the entire vibrio was in solution. It was also shown that 10 per cent. of the total nitrogen, 12 per cent. of the amino-nitrogen, between 10 per cent. and 13 per cent. of the total substance of the organisms, and from 45 per cent. to 65 per cent. of the polysaccharide must be removed before serological methods will indicate that the " H " antigen has been totally destroyed.

In a second paper the effect of salt and antisera on agglutination of the vibrios was studied. It is difficult to summarize this work save at considerable length, and accordingly reference may be made to its publication in the October, 1936, issue of the Indian Journal of Medical Research.

At present, most emphasis is being laid on the search for a serological basis for the chemical classification. The importance of having a relative simple method for differentiating the six chemical groups lies in the observation that all vibrios appear to fall into one or another of these groups, and that there is a good correlation between the source of the vibrios in cases, carriers or water on the one hand, and their chemical grouping and metabolic type on the other. It is hoped that

precipitin reactions with highly specific fractions will yield a basis for the serology of the vibrios which they do not have at present.

List of publications of the cholera inquiry under Dr. R. W. Linton:

Linton, R. W., Mitra, B. N., and Seal, S. C. Agglutination in the Vibrios, Part I. The Effect of Heat on Chemical Structure and Surface Potential. *Indian Jour. Med. Res., Vol. 24, No. 1.*

Linton, R. W., Mitra, B. N., and Seal, S. C. Agglutination in the Vibrios, Part II. The Effect of Salt and Sera. *Indian Jour. Med. Res., Vol. 24, No. 2.*

Linton, R. W., and Mitra, B. N., Vibrio Polysaccharides. *Indian Jour. Med. Res., Vol. 24, No. 2.*

Linton, R. W., Mitra, B. N., and Mullick, D. N. A study of the metabolism of 210 vibrio strains. *Indian Jour. Med. Res., Vol. 24, No. 2.*

Mitra, B. N. Absorption Spectra of the Proteins of Vibrio Cholerae and related Organisms. *Indian Jour. Med. Res., Vol. 24, No. 1.*

Mitra, B. N. Nucleic acid of Proteins of Vibrio Cholerae and related organisms. *Indian Jour. Med. Res., Volume 24, No. 1.*

REPORT OF THE TUBERCULOSIS INQUIRY.

(Financed by the Indian Research Fund Association.)

[DR. A. C. UKIL, M.B., M.S.P.E. (PARIS), F.N.I.]

Work done in 1936.—This inquiry has been attempting to elucidate the Epidemiology, Pathology and Bacteriology of Tuberculosis in India, besides devoting its attention to some cognate problems, like the part played by solar radiation in influencing tuberculous infection in the tropics, some non-tuberculous diseases which simulate tuberculosis, etc. The work already done by us in these spheres indicates that the problems here differ in certain essential aspects from those obtained in Europe or America.

I.—*The Tubercle Bacillus.*

(*a*) An attempt has been made, by culture and animal inoculation, to determine the source of tubercle bacilli in Pulmonary and non-Pulmonary lesions obtained from 136 patients and 64 Cadavers. Out of these, 106 strains have been typed out and 94 are under observation. The sources of the materials in 106 cases have been as follows: Cervical glands—44, Axillary glands—7, Mesenteric gland—1, Tracheo-bronchial glands—15, Inguinal gland—1, Bones and Joints—16, Skin lesions—2, Urine—1, Stool—1, Pleural fluid—13, Enucleated glands—2, and Sputum—3. All the strains were 'eugonic' and belonged to the *Human type*. 8 strains, mostly isolated from mesenteric glands, proved to be chromogenic pseudo-tubercle bacilli. Out of 184 autopsies utilised, 50 have been done during the period under review. Besides culture, a histological examination was done in a number of cases.

(*b*) A paper on 'A comparative study of culture *v.* animal inoculation as a means of isolating the tubercle bacillus from pathological materials' has been published in I. J. M. R., July 1936. The culture method has been shown to be a cheaper, quicker and useful method of demonstrating the nature and type of the bacillus than the more costly and slower method of animal inoculation.

II.—*Studies in Tuberculosis immunity among Indians.*

(*a*) An attempt has been made to correlate the tuberculisation of the population, as determined by tuberculin tests, with *post-mortem* findings in 115 apparently healthy persons dying of accidental deaths (accident, suicide or murder) autopsied at the Police Morgue, Calcutta. Evidence of tuberculous lesions was found in 47·8 per cent. of the cases, whereas the tuberculin reaction rate, based on 6,500 individuals, was found to be 45·9 per cent.—a close parallelism. The results when grouped according to age also showed a fair degree of resemblance. Active tuberculous lesions were found in 21 of the 115 autopsied apparently healthy individuals.

(*b*) A study of relative allergy and immunity in tuberculosis among Indians.

This is being studied by employing diluted tuberculin and by correlating clinical, X'Ray and histological evidences in lung lesions. It has been shown in one of our papers (1933) that allergic and exudative types predominated in rural and semi-rural areas, as judged from epidemiological data and radiological evidence and that the hyper-sensitivity of the Indian population to endemic infection was more marked than in the highly industrialised and urbanised European population.

In a series of 500 X'Ray diagnosed cases of Pulmonary tuberculosis, it has been found that exudative changes predominated in 86·3 per cent. of rural cases, 74·6 per cent. of semi-rural cases and 37·7 per cent. of urban cases. In our histological study of the lungs of 100 cases, in whom some evidence of tuberculosis has been found, active pulmonary tuberculosis was present in 59 cases. Among these, productive changes predominated in only 22 per cent. of cases, productive and exudative changes were almost equally operative in 25·4 per cent. of cases and exudative changes predominated in 49·1 per cent. of cases. No information could be obtained as to their rural, semi-rural or urban domicile. In assessing the findings, many other factors, such as dosage and frequency of infection, age, sex, and race, have got to be taken into consideration. These factors considerably influence the individual sensitivity to tuberculosis, the higher the sensitivity the less the capacity for limiting a progressive infection. It has been seen that allergic phenomena are more marked a feature of the disease here than in Europe. This biological dissimilarity in the average response to tuberculous infection between the European and the Indian races calls for an explanation and our work in this direction aims at it. An elucidation of the problem is likely to help us to properly assess the prognosis and treatment of tuberculosis cases in this country.

III.—*Transmission of infection from man to man.*

Under this heading, a study is being made of the question of the spread of tuberculous infection, morbidity and mortality in infected households, especially among children below 15 years by systematically examining the contacts by intra-dermic tuberculin test and X'Ray examination and following them up and by studying the available autopsy materials. Two papers on this subject are being contributed.

The following salient features have been noticed in a study of 444 children belonging to tubercular homes. Of these, 343 were in contact with 'Open' cases, 27 with 'closed' cases and 74 with 'unknown sputum' cases. 409 had 'intimate' contact, while 35 had 'distant' contact. Mantoux test was positive in 71 per cent. of the cases. Active parenchymal lesions were detected by skiagraph in 16 per cent., healed parenchymal lesions in 7 per cent. and definitely enlarged hilar glands in 36 per cent. of cases. No lesions could be detected in 41 per cent. of the cases. The percentage of positive tuberculin reaction was highest (90 per cent.) in the 'active lesion' series. Those with positive lesions generally gave a more intense reaction also, *i.e.*, the hypersensitivity was found to be directly proportional to the activity of the focus. Children in contact with 'Open' cases were found to be more

hypersensitive than those in contact with 'closed' cases. The percentage of positive reaction was found to vary *directly* with age, while the incidence of demonstrable lesions varied *indirectly* with age. Active lesions were found more frequently in the younger ages. The incidence of infection as detected by Mantoux test was found to be 12 per cent. higher than that detected by X'Ray.

A survey of the homes revealed that most of the inmates belonged to the poorer classes, that $\frac{2}{3}$rds were in houses with bad hygienic condition and that 50 per cent. had one-roomed tenements. As regards the incidence of Mantoux reaction and morbidity rate, no definite correlation was found between poverty and the state of health of the children. Among children, tuberculosis mortality was found to be double that of general mortality, whereas among adults tuberculosis mortality was found to be $3\frac{1}{2}$ times higher than general mortality. In the former case, a relatively high general mortality rate among infants in India as compared with that in other countries might have masked a wider difference in this country. "

IV.—*Other subjects connected with Tuberculosis in India.*

Two papers bearing on the influence of solar radiation on tuberculous infection and disease have been contributed in the course of the year under review. The salient features were noted in the last year's report.

V.—*Incidence of some non-tuberculous diseases which simulate tuberculosis*, e.g., *Bronchiectasis.*

No authentic data exist in this country regarding the incidence of this condition. A paper based on 200 cases, determined by intratracheal lipiodol bronchography, is being contributed. It has been shown that Bronchiectasis is of common occurrence in India, perhaps less so than in temperate climates and that every known form has been met with.

Post-graduate Course in Tuberculosis.—As in the previous year, a post-graduate course in Tuberculosis was also conducted at the Institute, lasting for 4 weeks, in the month of January 1936, under the auspices of the King George Thanksgiving (Anti-tuberculosis) Fund which was attended by 25 doctors from all over India and Burma.

Staff and Organisation.—The Officer-in-charge of this Inquiry is a voluntary worker. He has been ably assisted by Dr. S. R. Guhathakurta, B.SC., M.B., who acts as the Chief Medical Assistant, Dr. N. G. Mazumdar, M.B., who is in charge of histological work and Mr. A. G. Sinha, who attends to the preparation of media, care of animals, etc. I am glad to record here the able and loyal way in which they have helped me.

I take this opportunity to express my grateful thanks to Dr. R. B. Lal, Officiating Director of the Institute, for affording me accommodation and facilities for work at the Institute. I also desire to express my thanks to the authorities of the Calcutta Medical College and Hospitals and the Tuberculosis Association of Bengal for help in various directions.

Papers published or contributed during the year:

(1) A comparative study of culture and animal inoculation as methods for isolating tubercle bacilli from pathological materials. *I. J. M. R., July, 1936.*

(2) The extent and intensity of extreme Ultra-Violet radiation at Calcutta, with special reference to its therapeutic value. *I. J. M. A., Vol. VI, No. 2, Nov. 1936.*

(3) The action of sunlight as a factor in controlling tuberculous infection in guinea pigs. *Amer. Rev. of Tuberculosis* (*under publication*).

(4) Tuberculosis in infants and children, Part I. Epidemiological considerations (*under publication in I. M. G.*)

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Annual Report of the All-India Institute of Hygiene and Public Health, Calcutta, 1937

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All-India Institute of Hygiene and Public Health, Calcutta.

Staff—1937.

Director.

Dr. R. B. Lal, M.B., B.S., D.P.H., D.T.M. & H., D.B., F.N.I. (Officiating).

Assistant Director.

Lieutenant C. W. E. Peters, I.M.D. (part time from 28th January 1937 to 18th November 1937).

Captain K. Satyanarayana, M.B., B.S., A.I.R.O. (from 19th November 1937).

A.—Staff of the Institute of Hygiene.

Department of Public Health Administration—

Professor—Dr. R. B. Lal, M.B., B.S., D.P.H., D.T.M. & H., D.B., F.N.I. (Officiating).

Assistant Professor—Dr. S. C. Ghosal, M.B., D.P.H. (CAL.), D.B. (LOND.).

Department of Vital Statistics and Epidemiology—

Professor—Dr. K. C. K. E. Raja, L.M.S., L.R.C.P. & S., D.P.H., D.T.M. & H. (Officiating) (relieved by Dr. R. B. Lal from the 23rd October 1937).

Assistant Professor—Mr. Satya Swaroop, M.A. (from 9th August 1937 to 8th October 1937 and from 23rd October 1937 to date).

Mathematical Assistant—Mr. Satya Swaroop, M.A. (from 1st January 1937 to 8th August 1937 and again from 9th October 1937 to 22nd October 1937) rest of the period vacant.

Department of Biochemistry and Nutrition—

Professor—

Dr. H. Ellis C. Wilson, M.B., ch.B., D.SC.

Dr. Bashir Ahmad, M.SC., PH.D. (Officiating from 15th July 1937 to 23rd September 1937).

Assistant Professor—Dr. Bashir Ahmad, M.SC., PH.D. (from 1st January 1937 to 14th July 1937—vacant for the remaining period).

Department of Malariology and Rural Hygiene—

Professor—Dr. K. V. Krishnan, M.B., B.S., M.R.C.P., D.SC., F.N.I.

Assistant Professor—Dr. Banamali Ghosh, M.B., D.P.H.

Assistant Research Worker—Dr. Phanindra Nath Bose, M.B., D.P.H., D.T.M.

Department of Maternity and Child Welfare—

Professor—Dr. M. I. Neal-Edwards, M.D., W.M.S.

B.—Staff of the School of Tropical Medicine.

Department of Protozoology—

Professor—Dr. B. N. Das Gupta, L.M.P. (DACCA).

Assistant Professor—Dr. S. Sen, M.B., D.T.M. (Officiating).

Department of Pharmacology—

Professor—

Bt.-Col. R. N. Chopra, C.I.E., K.H.P., M.A., M.D. (CANTAB.), SC.D., F.R.C.P. (LONDON), I.M.S. (from 1st January 1937 to 14th July 1937 and from 15th August 1937 to 31st December 1937).

Dr. J. C. Gupta, M.B. (Officiating from 15th July 1937 to 14th August 1937).

Assistant Professor—Dr. J. C. Gupta, M.B. (CAL.).

Department of Public Health Laboratory Practice—

Professor—Dr. A. K. Sen, B.SC., M.B. (CAL.), D.P.H. (ENG.), M.R.C.P. (EDIN.).

Assistant Professors—

Dr. R. Banerjea, M.B., D.P.H. (CAL.).

Mr. Nani Lal Banerjee, M.SC. (CAL.), A.I.C.

Department of Bacteriology, Pathology and Helminthology—

Professor—Major C. L. Pasricha, M.A., M.B., B.CHIR. (CANTAB.), M.R.C.S. (ENG.), L.R.C.P. (LONDON), I.M.S.

Assistant Professor of Bacteriology—Dr. Ganapati Panja, M.B (CAL.), D.B. (LONDON).

Assistant Professor of Pathology—Dr. Kalipada Banerjee, M.B., D.T.M. (CAL.).

Department of Entomology—

Professor—

Dr. C. Strickland, M.A., M.D. (CANTAB.), B.CHIR. (from 9th March 1937 to 20th October 1937 and from 5th November 1937 to 31st December 1937).

Dr. D. N. Roy, M.D. (CAL.), D.T.M. (CAL.) (from 1st January 1937 to 8th March 1937 and from 21st October 1937 to 4th November 1937).

Assistant Professor—Dr. D. N. Roy, M.D., D.T.M. (CAL.).

Department of Serology and Immunology—

Professor—Major S. D. S. Greval, B.SC., M.D., ch.B., D.P.H., I.M.S.

Assistant Professor—Captain S. N. Chandra, M.B. (CAL.).

Department of Chemistry—

Professor—Dr. Sudhamoy Ghosh, M.SC., D.SC., F.R.S., F.C.S. (LOND.).

Assistant Professor—Mr. Nihar Ranjan Chatterji, M.SC. (CAL.).

C.—Special Research Staff under the Indian Research Fund Association.

1. Cholera Carrier and Epidemiological Enquiries—

Officers-in-charge—

(1) Dr. R. B. Lal, M.B., B.S., D.P.H., D.T.M. & H., D.B., F.N.I.

(2) Major C. L. Pasricha, M.A., M.B., B.CHIR. (CANTAB.), M.R.C.S. (ENG.), L.R.C.P. (LOND.), I.M.S.

(*a*) *At Headquarters*—

Research Assistant—Mr. K. C. Basak, B.A. (CANTAB.).

Bacteriologists—

Dr. Srish Chandra Seal, M.B.

Dr. Promode Chandra Das, L.M.F.

(*b*) *Field Section*—

Epidemiologist—Dr. Jayanta Kumar Bhattacharjee, B.Sc., M.B., D.P.H.

Assistant Bacteriologist—Dr. Monoranjan Kar, M.B., D.P.H. (up to 31st March 1937).

2. Cholera Structural Enquiry—

Officer-in-charge—Dr. R. W. Linton, PH.D.

1st Assistant—Dr. D. L. Shrivastava, D.Sc.

2nd Assistant—

Dr. B. N. Mitra, D.Sc. (from 9th October 1937).

Mr. B. N. Majumdar, M.Sc. (Officiating) from 1st January 1937 to 31st May 1937.

Mr. S. P. Mukherji, M.Sc. (Officiating) from 17th May 1937 to 30th September 1937.

Assistant Chemist—Mr. S. P. Mukherji, M.Sc. (from 1st October 1937).

3. Tuberculosis Enquiry—

Officer-in-charge—Dr. A. C. Ukil, M.B. (CAL.), M.S.P.E. (PARIS), F.S.M.F. (H.C.), F.N.I.

Medical Assistant—Dr. S. R. Guha Thakurta, B.Sc., M.B.

Histologist—Dr. N. G. Mazumdar, M.B. (up to 31st March 1937).

4. Blackwater Fever Inquiry—

Officer-in-charge—Dr. K. V. Krishnan, M.B., B.S., D.B., M.R.C.P., D.Sc., F.N.I.

Organic and Physical Chemist—Mr. N. Gopala Pai, M.Sc.

5. Maternal Mortality and Morbidity Inquiry and Anæmia and Eclampsia Inquiry—

Officer-in-charge—Dr. M. I. Neal-Edwards, M.D., W.M.S.

Lady Doctors—

Dr. S. Pandit, M.B., B.S., D.M.C.W.

Dr. F. M. Shaw, M.B., B.S., L.R.C.P. (up to 30th June 1937).

Dr. Sita Dharamvir, M.B., B.S. (from 1st September 1937).

Pathologist—Dr. D. N. Mukherji, M.B. (from 9th August 1937).

6. Investigation of Indian Foods—

Officer-in-charge—Dr. H. Ellis C. Wilson, M.B., Ch.B., D.Sc.

Chemist—Mr. G. K. Roy, M.Sc.

ANNUAL REPORT OF THE ALL-INDIA INSTITUTE OF HYGIENE AND PUBLIC HEALTH FOR THE YEAR 1937.

During the year under report, Dr. K. C. K. E. Raja, Officiating Professor of Vital Statistics and Epidemiology, was transferred as Medical Statistician in the office of the Public Health Commissioner with the Government of India with effect from 22nd October 1937. For the rest of the year the Director held charge of this Section in addition to his own duties. The post of Assistant Professor of this Section which had remained vacant throughout last year was filled up temporarily by Mr. Satya Swaroop, Mathematical Research Assistant. His post in turn remained vacant for the rest of the year.

Dr. Bashir Ahmad, Assistant Professor of Biochemistry and Nutrition proceeded on Rockefeller Foundation Fellowship on the 23rd September; his post also remained vacant for the rest of the year. Dr. H. E. C. Wilson, Head of this Department, submitted his resignation.

Lt. C. W. Peters, I.M.D., joined his duties as part time Assistant Director on the 28th January. He vacated the post on the 19th November and handed over charge to Capt. K. Satyanarayana, M.B., B.S., A.I.R.O.

The financial responsibility for the Maternity and Child Welfare Section was taken over by the Government of India from the beginning of the financial year 1937-38. Towards the end of the year Mrs. Gita Devi was appointed as Nursery School Teacher in place of Miss Leonora Jordan who had resigned her post.

Sanction for the opening of the Sanitary Engineering Section was also received and steps to appoint the necessary staff were taken in hand.

Teaching.—Now that the Institute has completed four years of existence and has produced four batches of Diplomates in Public Health, it was considered desirable to take stock of the situation. As a preliminary step an inquiry was instituted with a view to ascertaining how far the country had made use of our graduates and how they were being employed. A request was made to the ex-students to supply information regarding their employment and the nature of their duties. Of a total of 82 persons who had graduated since September 1934, 71 responded. Of the latter, 47 including 11 passed in 1937 are holding various types of public appointments and 24 are engaged in private practice. While it is to the advantage of the public that members of the independent medical profession should possess public health qualifications, such persons could be employed to better advantage in public health services. The state is still the biggest employer of our students, for 32 out of 47 in service are state employees and only 15 are employed by Local Bodies and other authorities. The conditions of service are not quite satisfactory as only 26 hold permanent posts; the rest are employed on temporary basis. Medical Departments have provided employment to 10 persons, 5 are serving in rural areas, 4 in urban areas, and 1 in the railways. Only 4 persons occupy laboratory posts,

and 4 are engaged in research. Of the 29 who are employed in public health work, 17 are serving in rural areas, and 12 in urban areas. It must be admitted that public health services for which training in the Institute is specially designed have so far absorbed a relatively small number of graduates. It is hoped that in the coming years a larger number of them will find employment in public health work. Progress in this direction will be watched with considerable interest.

This analysis further shows that the prospects of employment in laboratory service are comparatively few. It serves to draw attention to the fact that in the present curriculum a disproportionately large amount of time is spent in laboratory training. A revised syllabus has, therefore, been prepared in which essential training in laboratory subjects has been retained, but emphasis has been shifted to applied public health subjects. This syllabus is at present under consideration. Certain changes have also been suggested in the course for the Diploma in Maternity and Child Welfare. These modifications in the syllabus require careful consideration and it is hoped that in due course, a course of instruction more suited to the requirements of the country will evolve.

Considerable difficulty was experienced in providing facilities for training of D. M. C. W. students in Venereal Diseases and Diseases of children. It is, however, hoped that with the extension of the Dufferin Hospital these requirements will be adequately met.

After the termination of the course, a number of seminars were held in which the students offered papers on various subjects and took part in the discussions that followed. Finally, the Professor-in-charge expressed his views.

Courses held.

D. P. H. and D. P. H. & Hy.—Demand for admission to the D. P. H. course greatly in excess of the available accommodation, which was commented upon in last year's report, was also experienced this year. The number of applications received this year was the same as last year, namely, 74. Of these 63 possessed medical degrees or equivalent qualifications and 11 were licentiates. Fifty-six were graduates of more than one year's standing and as such were eligible to sit for the next D. P. H. Examination of the Calcutta University. Twenty-six of them were admitted to the D. P. H. Course. Six licentiates were selected for the D. P. H. & Hy. Course of the Faculty of Tropical Medicine and Hygiene, Bengal. The constitution of the class was as follows: Indian Medical Service *nil*, Indian Medical Department 2, Provincial Medical Service 1, Indian States Service 2, Provincial Public Health Service 3, Public Health Service under Local Bodies 3, Railway Service 2, other agencies (including mercantile firms, shipping Co., tea plantations, jute mills, mines, industries, etc.) 1, and private practioners 18, total 32. It is obvious from this statement that most of the students are still drawn from the independent profession, and many of them are prospective candidates for public services.

The distribution according to provinces was as follows:—Assam 1, Bengal 13, Orissa 2, Hyderabad 2, Central Provinces 1, Bombay 2, Bihar 4, United Provinces 2, Punjab 3, N. W. F. Province 1, and

Burma 1, total 32. The Burmese student was a Fellow of the International Health Board of the Rockefeller Foundation. Two students gave up the course before completion.

Special Post-Graduate Course.—Three students were admitted to special courses. Two took Biochemistry and Nutrition as their special subject and one took a course in Vital Statistics and Epidemiology.

D. M. C. W. Course.—Two students joined the course; one resigned for private reasons.

Examination results.

D. P. H., Part I.—Twenty-two students appeared and 15 passed in the May Examination; 10 appeared and all passed in the September Examination.

D. P. H., Part II.—Four appeared in May and three passed, while 26 appeared and 21 passed in September. A University medal was, for the first time, awarded to Dr. K. G. Govil.

D. P. H. & Hy., Part I.—Six appeared and 4 passed in May Examination and 2 appeared and passed in September Examination.

D. P. H. & Hy., Part II.—Two appeared and 1 passed in May Examination and 6 appeared and 3 passed in September Examination.

D. M. C. W., Part I.—One appeared and passed in January Examination.

D. M. C. W., Part II.—One appeared and passed in July Examination.

Research and investigations.

Cholera. The statistical investigations on cholera incorporated in the report of the Professor of Vital Statistics and Epidemiology deal with the formation of cholera districts on the basis of trivariate analysis of variance and the epidemiological characteristics of each district. As to the reason why one district should present epidemiological features different from the other, studies on the msteorological and density bases have yielded negative results. The forecasts of cholera epidemics in Calcutta prepared by the new method fairly approximate to the actual happenings. Field studies in four selected areas exhibiting different epidemiological features have been carried out but no definite results have so far been obtained. Greater details regarding the spread of infection from cases and carriers as well as from the environmental sources and further information regarding the persistence of infection are contained in the same sectional report.

Dr. Linton's report contains an important observation, namely, variations affected in single cell cultures which involve biochemical, serological, and structural changes. He has made further advance in differentiating the polysaccharides of organisms isolated from patients in the beginning of epidemic, end of epidemic, and from non-cholera sources by means of simple tests.

Dr. Ghosal continued his studies on the changes undergone by vibrios through passage in flies. He obtained confirmation of his last year's results.

Epidemic Dropsy.—The results obtained by this Inquiry have stimulated considerable interest in the ætiology of this mysterious disease in India and abroad. Now that a fresh supply of potent mustard oil has been obtained, it is hoped that some light will be thrown on the nature and origin of the toxic substance in the oil and means will be found of distinguishing safe from unsafe oil by methods other than the human experiment.

Population Studies.—Workers in the Institute have directed attention to the investigation of this problem. Those interested will find references to these studies at the end of the sectional report.

Other Statistical Studies.—Attention may be drawn to the infant mortality studies by Mr. K. C. Basak and to the investigations on the interpretation of results of bacteriological analysis by Mr. Satya Swaroop.

Changes in the Basal Metabolism under the influence of variation in temperature and humidity.—The health status of an individual must necessarily be considered in terms of the range of adjustability which he possesses in relation to environmental variations. In this country, where we find extremes of climate and marked seasonal variations studies on the influence of these factors on human organism are of special interest. As a preliminary step, observations of changes in basal metabolism, in healthy young men, induced as a result of variations in temperature and humidity were investigated. It was found that the basal metabolism of Indian subjects under climatic conditions prevalent in Calcutta during the monsoon season when the temperature ranges from 85° to 95° F. and relative humidity from 67 to 80 per cent. is definitely lower than the recognised American and European standards. Sudden removal of the individual to a chamber with a temperature varying from 75° to 80° F. and relative humidity from 51 to 59 per cent. causes still further lowering of basal metabolism.

Blackwater Fever and Malaria.—Dr. Krishnan's pathological and therapeutic researches on this disease reached the final stage this year. The successful treatment of seven cases of blackwater fever reported by him should inspire confidence amongst those who are destined to extend the bounds of human civilisation into tropical jungles.

It is interesting to note that ascorbic acid which forms one of the constituents of his treatment and which he has found useful in treating ordinary malaria patients has been extensively used as a specific against this disease by lay people in the form of lemon juice in many parts of this country.

Dr. Krishnan's report contains further details of the studies on the maladjustment of environmental factors in relation to *A. culicifacies* in Bengal which explains why this species fails to carry malaria.

Kala-azar.—Interesting observations on the immunity reactions in this disease will be found in Dr. Krishnan's report which suggests that anti-bodies fail to exercise their specific action *in vivo* on account of the intra-cellular position of the parasites.

Maternal Mortality.—Gravity of the situation with regard to maternal mortality in India has been universally recognised. It is, in fact, one of the most pressing problems requiring solution. The

sectional report of the Professor of Maternity and Child Welfare gives results of investigation of 889 maternal deaths in Calcutta. It clearly shows that maternity need not be attended with any risk if the expectant mother is carefully looked after and trained midwives are in attendance. The data provided by this inquiry should serve to convince the Provincial and Local Authorities that money spent on organising maternity and child welfare clinics would bring about immediate and assured results.

Anæmia of Pregnancy.—The results of the maternal mortality inquiry have indicated that anæmia *per se* is one of the main causes of maternal deaths. Besides it is a contributory cause in mortality due to sepsis and other causes. The preliminary studies indicate that the blood of healthy Indian women conforms to the accepted European hæmatological standards. The causes leading to anæmia of pregnancy are, however, not clearly understood. The present inquiry is likely to indicate what specific measures will help to minimize the dangers arising from this important cause of death.

Other Maternity Problems.—Considerable amount of useful data concerning pregnant women have accumulated in the Child Welfare Clinic attached to the Institute. These data were partly analysed during the year. Brief references to some interesting problems such as incidence of rickets, blood pressure in pregnancy, mean duration of normal labour, etc., are contained in Dr. Neal-Edward's report.

Biochemistry and Nutrition.—Dr. Wilson's report contains comparative results of nutrition surveys undertaken amongst different communities. It serves to show that the dietetic habits of the people vary greatly in different parts of India and that the nutritional state is correlated with the economic status. His inquiry also shows that the number of live children per family varies directly with the economic condition. It would have been interesting to know if information about total births had also been collected, because it would have shown whether the poor classes give births to more children than they can support.

Diet containing green vegetables and *dals* to remove the deficiency in the food of the poor people, as suggested by Dr. Wilson, appears to be a practical proposition. Intensive propaganda for the purpose is required.

Of other studies carried out in Dr. Wilson's Department, mention may be made of the assay of flavine and vitamin B_6 in Indian foodstuffs, biochemical changes in blood of various types of anæmia, basal metabolism of Indian boys and daily excretion of vitamin B_1, in the urine of healthy persons on different types of diet. His investigations on cataract suggest that the condition is due to the deficiency of one of the factors in vitamin B complex, other than flavine or B_6.

Tuberculosis.—Dr. Ukil's report contains, as usual, a mine of information on the various aspects of the epidemiology of tuberculosis in India. It will no doubt be read with much interest in this country and abroad. The large body of workers whose interest in tuberculosis has recently been awakened through the appeal issued by Her Excellency the Marchioness of Linlithgow will find much in the report of this section which will help them to organise the campaign on a scientific basis. The studies on tuberculosis amongst industrial workers and their

home contacts in urban and rural areas promise to yield important results.

Stipends.—A stipend of Rs. 50 per mensem kindly offered by the Indian Red Cross Society was granted to one of the D. M. C. W. students. Since, however, she left the Institute in December, the stipend was given to the other student.

Accommodation.—The re-arrangement of accommodation for different sections reported last year worked very satisfactorily. All available accommodation on the 3rd floor was made over to the Drug Standardisation Laboratory which has been organised under the Directorship of Bt.-Col. R. N. Chopra, I.M.S. A scheme was prepared to convert the residential quarters on the top floor into laboratories.

No satisfactory arrangements for students' residence could be made. Difficulty is particularly felt in finding accommodation for women students. The Institute is grateful to the Principal, Calcutta Medical College for permission to use hostel accommodation for the D. M. C. W. students.

Museum.—The museum was wholly re-organised. Many new exhibits were added and some old ones were replaced by new. Moveable stands to provide about 1,000 sq. ft. of extra space were put in.

The students are encouraged to make use of the museum which is of considerable help to them. Most of the medical schools in Bengal in and outside Calcutta sent their students and held demonstrations in the museum. The facilities provided were greatly appreciated. Many requests for advice in putting up hygiene museums in various institutions were received and all possible assistance was given. Much credit for the present arrangements and improvements is due to Capt. K. Satyanarayana and Dr. S. C. Ghosal.

Library.—One hundred and forty-eight books, 127 reports and 108 bound volumes of journals were added to the library this year. This brings the total volumes to 5,431. Fifty journals were subscribed for and twenty were received free of cost. Writer's thanks are due to the donors. Every effort was made to avoid reduplication by collaborating with the library of the School of Tropical Medicine.

General Observations.—The Director General, Indian Medical Service, and the Public Health Commissioner with the Government of India visited the Institute.

Among other distinguished visitors the names of Dr. W. Chung of China and Dr. M. N. Saha, F.R.S., may be mentioned.

A symposium on malaria was organised under the auspices of the National Institute of Sciences of India by the writer with the co-operation of Dr. K. V. Krishnan. It was presided over by Dr. M. N. Shaha, D.SC., F.R.S. Twenty-eight papers dealing with different aspects of malaria of special interest to India were read by malariologists from all over the country. The papers were followed by valuable discussion. They were edited and submitted to the Council of the Institute for publication by Dr. Krishnan and the writer.

The monthly meetings of the senior staff and the joint meetings of the research workers of the Tropical School, and the Institute were held as usual.

Monthly meetings of the Public Health Society were held in which a variety of subjects relating to public health were discussed. These meetings as well as those held in the School of Tropical Medicine under the auspices of the Royal Astiatic Society of Bengal were largely attended by the students.

Students were also admitted to the meetings of the Biochemical Society held in the Institute.

A malaria exhibition and a series of lectures on malaria were arranged by Dr. K. V. Krishnan for the benefit of the general medical profession. These were largely attended.

The Institute Restaurant worked satisfactorily. It was fully made use of by the members of the staff and the students; their thanks are due to Mr. Satya Swaroop, the Honorary Secretary, for his efficient management.

One month's special course in tuberculosis under the auspices of the King George's Thanks Giving (Anti-Tuberculosis) Fund was held on the same lines as last year. There is a demand for a larger course which will prepare senior personnel for employment in the various anti-tuberculosis schemes under the King Emperor's Anti-Tuberculosis Fund, but the Institute is unable to organise such a course at present, on account of deficient staff.

Acknowledgments.—I gratefully acknowledge the help which I have received from my colleagues and co-workers in the Institute and the School of Tropical Medicine. Dr. H. Ellis C. Wilson (leaving shortly), Dr. Neal-Edwards, Dr. K. C. K. E. Raja, Lt. C. W. Peters, and Dr. R. W. Linton, who have unfortunately left the Institute will be remembered with affection by their colleagues and students. As in previous years, Bt.-Col. R. N. Chopra, C.I.E., K.H.P., F.R.C.P., SC.D., I.M.S. continued to extend his valuable co-operation for which the writer is specially grateful.

It is a pleasure to acknowledge with thanks the assistance received by the Institute from the officers of the various organisations to whom our students were sent to receive part of their training.

The authorities of the Indian Research Fund Association deserve special thanks for generously providing funds for a number of Enquiries. We are also grateful to Dr. W. P. Jacocks and the authorities of the International Health Board of the Rockefeller Foundation for the grant of a Fellowship to Dr. Bashir Ahmad, Assistant Professor of Biochemistry and Nutrition whose further training abroad will be of special benefit to the Institute.

Lt.-Col. M. A. Singh, I.M.S., Lt.-Col. S. L. Patney, I.M.S., and Lt.-Col. M. Das, I.M.S. deserve my special thanks for their help and co-operation in investigations on epidemic dropsy.

REPORT OF THE PROFESSOR OF VITAL STATISTICS AND EPIDEMIOLOGY.

(Dr. R. B. Lal, M.B., B.S., D.P.H., D.T.M. & H., D.B., F.N.I.)

Staff.—In last year's report reference was made to the inadequacy of the staff in the department. Dr. K. C. K. E. Raja, who had continued to act as Professor in addition to his own duties as Assistant Professor, handed over the charge to me on his transfer as Medical Statistician in the office of the Public Health Commissioner with the Government of India. Mr. Swaroop, Mathematical Assistant, was appointed temporarily as Assistant Professor. His post remained vacant.

Teaching.—The usual course in General and Special Epidemiology and Vital Statistics consisting of lectures, demonstrations and practical classes was given to the students preparing for D. P. H. Examination of the Calcutta University and D. P. H. & Hy. and D. M. C. W. courses of the Faculty of Tropical Medicine and Hygiene, Bengal. Two seminars were held at the end of the course.

Research.—In last year's report reference was made to some of the results obtained by the two Indian Research Fund Association Enquiries under my charge. These enquiries were continued but the field unit of the Cholera Carrier and Epidemiological Enquiry located at Diamond Harbour was disbanded with effect from the 1st April and only certain epidemiological observations were carried on with the assistance of a small staff.

Cholera Carrier and Epidemiological Enquiry.—The Enquiry, as in previous years, can be fundamentally divided into two sections—(1) Statistical Section, and (2) Field Section.

(1) *Statistical Section.*—The main purposes of the section were defined in last year's report. Reference was made to the combination of *thanas* into homogenous cholera districts.

The formation of the cholera districts was completed during the year. A description of the methods employed has been published in the Indian Journal of Medical Research in its issue of July 1938.

Epidemiological characteristics including estimates of mean mortality, seasonal, monthly and yearly variability and of the general secular trends were worked out for all the homogenous districts. This study shows that (1) the homogenous districts vary greatly in size; (2) they are by no means co-terminous with the political districts; (3) the mean incidence varies greatly from district to district; (4) seasonal variation is comparatively small; (5) yearly variation is very variable being very high in some and low in others; (6) western districts, unlike the rest of Bengal, show a slight tendency to rise in cholera incidence during the monsoons; thus approaching the seasonal curve for Bihar; (7) the residual variation being small in all the districts except two, inference may be drawn that total variation is mostly explicable by seasonal and yearly factors. These varying characteristics of the homogenous cholera districts suggest that there are factors responsible for the differences in their cholera history. Besides field studies, which will be

described in the next section, statistical studies on the rôle of climatic factors such as temperature, humidity, rainfall and number of rainy days were carried out. It was found that, if allowance was made for the seasonal, yearly and other factors associated with the places the meteorological data on the whole failed to establish significant correlations. Further work on these lines is in progress.

The association between density of population and cholera mortality was studied by the method of partial correlation keeping the area fixed. The results were insignificant.

Forecast.—Reference was made in last year's report to a new method of forecast which was being tested. The new method which depends upon working out the regression equations connecting the mortality in certain weeks of the year with the total mortality for the succeeding year was applied to Calcutta experience. The standard error of the predicted values was also worked out, thus setting limits to the range of variation in the forecast. The forecast for 1937 and the test forecasts for 1935 and 1936 agreed fairly well with the actual cholera experience of the city. The method appears to be efficient for endemic areas.

An investigation on the value of Rogers' method of cholera forecast was also undertaken. A series of 2 tests and certain other tests threw doubt on the validity of Rogers' theory of a critical humidity level. In any case Rogers' method does not seem to be very helpful in forecasting epidemics in Calcutta. Successful results were obtained by his method in 24 per cent. of cases as against 83 per cent. with the new method. The method of forecast elaborated by Bundesen and Hedrich was applied to Calcutta experience but the results were not satisfactory.

(2) *Field.*—A brief description of the main findings of the field inquiry at Diamond Harbour is given below.

Dissemination of infection from cases of cholera.—The carrier rate of the contacts of cholera cases was significantly higher than that of the general population excluding contacts and cases. Classifying the cases into epidemic and sporadic cases, according as the first case is followed by one or more subsequent cases or not, the carrier rate of the contacts of sporadic cases was seen to be not significantly different from that of the general population while that of the epidemic cases was definitely higher. There is therefore evidence of spread of infection from epidemic cases to the person in contact with them.

When the weekly cholera cases were correlated with the carrier rates of the general population, excluding cases and contacts, for (1) the same week, (2) the first succeeding week and (3) the second succeeding week respectively, it was found that there was no significant correlation. This suggests that there is no evidence of the spread of infection from cases to the general population and that the range of dissemination of infection appears to be limited to the contacts. Case to case infection appears therefore to play a more important part than infection through environmental sources.

Comparison of the carrier rates in the general population of the affected and unaffected villages showed that there was a general similarity between the two sets of distributions. Seasonal factors are therefore influencing the carrier rate more than the incidence of cholera. When

the investigations were confined to the carriers of Inaba O organisms only, which are believed to be specifically related to cholera, the affected villages showed a higher rate than the unaffected villages but statistical analysis could not be proceeded with because of the smallness of the size of the data available.

Persistence of infection among carriers.—The results of the follow-up of 108 carriers of all types including 24 Inaba O positive carriers were in conformity with those given in last year's report.

Epidemic Dropsy Inquiry.—The researches carried out into the ætiology of epidemic dropsy during the past three years at this Institute have supported the conclusion that the disease is caused by some deleterious substance introduced through mustard oil, which is almost universally used as cooking oil in North-Eastern India. The experimental and epidemiological evidence in support of this theory were published in five papers in the Indian Journal of Medical Research and in the British Medical Journal, to which references have been made at the end of this report.

Various unsuccessful efforts were made to discover the toxic substance in the oil which is responsible for the production of the disease.

Suspicion naturally fell first on allylisothiocyanate which is responsible for the pungency in the mustard oil. This substance is sometimes added artificially as oil of sinapis to improve the commercial value of the oil. It was, however, found that the whole of this substance was lost during the process of cooking, specially when allylisothiocyanate was added artificially. It also proved non-poisonous to rats even when given in very large doses. Moreover, the allylisothiocyanate content of samples of oil obtained from certain families who had been using it for a fortnight or more without any ill effects was greater than that of the sample from Jamshedpur which had been used successfully in human experiments. It is also stated by pharmacologists that the signs and symptoms of poisoning with cyanides are different from those observed in epidemic dropsy. From these evidences it would appear that the toxic element responsible for epidemic dropsy is probably not allylisothiocyanate. A paper on the subject has been submitted for publication.

The suspected mustard oil was also fractionised and used in a human experiment to see which fraction contained the toxic element. This experiment proved unsuccessful but the whole oil was found to be impotent.

The poison may be derived from the seed which had undergone deterioration on account of faulty storage and fungus growth. A specific disease of mustard seed would explain why the disease, as we know it in this country, is confined to mustard oil consumers only. To test this hypothesis oil extracted from musty mustard seeds was used for feeding experiments on human volunteers. The results were all negative. It is, however, possible that the seeds used in this experiment were not infected with the specific organisms which produced the poison. Another possibility is that the toxic substance is derived from some other seeds or oils which might be added to mustard oil in the course of preparation or sale, unwittingly or deliberately for purposes of adulteration. Work on these lines is in progress.

In view of the divergence of opinion as regards the origin and significance of opacities found in some rice, the bacteriological work reported in this connection in last year's report was very carefully repeated a large number of times. These studies served to confirm our previous findings. The only new point which emerged was that surface sterilization of certain types of rice particularly of the variety known as " balam " could not be effected by the formalin method advocated by certain workers. Some other varieties, on the other hand, could be more easily sterilized by this method.

Besides the two enquiries, the Department carried out other investigations which are briefly reviewed below:—

(1) *Studies on population.*—Since the publication of the census report for 1931 much interest has centred round the problem of India's growing population. Last year a number of papers on the trend of population growth were contributed by the department. During the year under review the work was extended to investigations on the probable trend of demographic characteristics such as birth and death-rates and age constitution. Following Lotka's suggestion, suitable equations were developed for the purpose on the basis of logistic law. The calculated curves gave fairly good fit to the actual experience. The investigations further suggested that the measures directed towards the reduction of mortality will tend to lower the birth rate without conscious effort.

A statistical analysis of infant mortality in India was carried out with a view to studying the trends and the associated factors. It was found that there was evidence of decline in infant mortality in India in recent years but as compared with Great Britain it was less marked and much more variable.

A critical study of the demographical data collected in the course of cholera investigations at Diamond Harbour was made. A paper on the subject is under preparation.

(2) *Tables for exact significance tests.*—The problem of determining the exact probability of occurrence of a difference of a given size in responses under two sets of conditions assumes great importance when experiments are carried out on small numbers. The usual test employed in such cases gives only approximate values and is, therefore, not quite satisfactory. Using the method described by Fisher, tables of exact values of probability were prepared for pairs of sample sizes valuing from 5 to 50. Further work is in progress.

(3) *Estimation of the most probable numbers of organisms in water samples by the dilution method.*—The method usually adopted for the purpose is that laid down in the Ministry of Health reprint 71 (1934) and the tables which are mostly consulted are those calculated by McCrady. Tables setting out the value of probable numbers on a more exact basis and their standard errors are under preparation.

Help rendered to other enquiries.—Analysis of data collected by the Maternal Mortality Enquiry was carried out for the Officer-in-charge of the Enquiry. Special studies of two subjects were made in this connection—(*a*) seasonal factor in Maternal Mortality due to puerperal sepsis, Eclampsia and Anæmia, (*b*) study of relationship of eclampsia incidence and humidity both relative and absolute.

Cholera Bacteriophage Enquiry.—Records of 10,000 cases in this connection were received from Dr. E. Milford Rice of Assam. They were subjected to detailed analysis with a view to verifying the results as published in 1934 in the Indian Journal of Medical Research and investigating whether further information could be obtained from them.

Malaria Enquiry in Assam.—Dr. Rice also submitted for statistical analysis some data relating to the incidence of different types of malaria parasites and gametocytes in non-fever cases drawn from samples of populations in different areas of Assam. An elaborate analysis was carried out in order to bring out significant differences in the incidence of both sexual and asexual forms of parasites as between years, months, age periods and different types of infection.

Tuberculosis Association of Bengal.—Valuable data on clinical and pathological aspects of tuberculosis are being collected by the various dispensaries organised by the Association. Arrangement was made with this organisation to put all their cases on schedules specially designed for the purpose. An assistant was trained for the Association and analysis of the data was proceeded with. It is hoped that many points of importance to clinicians and health workers will emerge from this study.

Forecasting of Cholera.—At the request of the Ministry of Interior Iraq a forecast of cholera in Sind and Bombay Presidency for 1935 was worked out by Sir Ronald Rogers' methods.

Besides these specific studies the department continued to extend co-operation to workers in the Institute and School of Tropical Medicine who required assistance for the computation and statistical evolution of their results. This involved considerable computational work and put a heavy strain upon the staff.

The department has suffered a great loss on account of Dr. Raja's transfer to Delhi. Of the junior staff Mr. P. K. Chowdhury deserves special mention on account of his devoted services to the department.

The following papers were published from this department during the year:—

(1) Lal, R. B., and Roy, S. C. (1937).	Investigations into the epidemiology of epidemic dropsy.	Part I.—Introductory notes and historical survey.	I. J. M. R. No. 1 Vol. XXV, p. 163.
(2) Do. Do.	Do. Do.	Part II.—A summary of field studies.	Do. , p. 177.
(3) Lal, R. B., Roy, S. C., and Ghosal, S. C.	Do. Do.	Part III.—Laboratory studies on rice as the ætiological agent.	Do. , p. 215.
(4) Lal, R. B., and Roy, S. C.	Do. Do.	Part IV.—Experiment to test the validity of the infection theory.	Do. , p. 233.
(5) Do. Do.	Do. Do.	Part V.—Feeding experiments on human volunteers.	Do. , p. 239.
(6) Do. Do.	Epidemiology of Epidemic Dropsy.	....	Br. Med. Jl., Vol. I, p. 1110.
(7) Raja, K. C. K. E.	A plea for a forward public health policy in India.	....	I. M. G., July 1937.
(8) Lal, R. B.	Malaria forecast	....	Proc. Nat. Inst. Sc, 1937.

REPORT OF THE PROFESSOR OF BIOCHEMISTRY AND NUTRITION.

(Dr. H. Ellis, C. Wilson, M.B., Ch.B., D.Sc.

The activities of the department during the past year have been directed to a continuation of the laboratory and field work in nutrition and allied clinical problems.

Field Work.—Under the scheme approved by the Nutrition Advisory Committee, a number of diet and physique surveys have been carried out during the year under review with the help of Dr. Durgadas Mitra who was appointed by the Indian Research Fund Association for this work. Four types of communities in different areas were selected for diet and clinical surveys, namely, industrial workers in Assam—the coolie class, the middle class agriculturists in Bengal, the well-to-do Calcutta households and a mixed middle class community in Ferozepore, Punjab. This latter survey was carried out independently by Dr. Bashir Ahmed, the Assistant Professor, in collaboration with Mr. Hamid Khan Gore.

The diet of the Assam coolies was found to be poor in total calories (2,086 per consumption unit or c.u. on the Stiebling scale) in total proteins, in fat, in calcium, in vitamin A and in carotene, also to a lesser degree in vitamin C and in iron. Most of the families took no milk the average consumption per c.u. being less than half an ounce per day. Conditions were somewhat better among the middle class agricultural group although the fat and the animal protein intakes were low. The diet of the well-to-do people in Calcutta was almost as good as that recommended to the European standards. A special distinguishing feature of the Indian diet, however, was a marked increase in the fat-intake with the rise in economic scale.

Together with the diet surveys, the children were examined for height, weight, A. C. H. index of nutrition, hand dynamometer grip and for clinical signs of deficiency such as angular stomatitis, phrynoderma, caries, malocclusion of teeth, enlarged tonsils, xeropthalmia and Bitots spots. The heights and weights of the Assam children were much below those of the well-to-do group in Calcutta and those of the rural children were midway. A similar trend was noted for the dynamometer grip at each age group. While the absolute gain in weight per year was somewhat greater in the Calcutta children, growth expressed as a percentage increase in body weight per year was actually greater in the coolie class in Assam. In spite of the poor diet the growth impulse appeared to be as good as among the well-to-do. The dynamometer grip expressed in relation to body weight (age neglected) was also greater in the poorer class. This would indicate that they had probably a greater proportion of muscle tissue per unit of body weight than the better off group.

Clinical Signs of Deficiency.—Xerophalmia was found only among the Assam children, the condition being present in 15 per cent. of boys and in 7·9 per cent. of girls. Bitots spots indicating more advance stage of vitamin A deficiency was seen in 2·4 per cent. boys and

0·8 per cent. girls. The intake of vitamin A including carotene was 1,000 IU per c.u. which amount was apparently inadequate to prevent symptoms of deficiency, at least, in children who were on an otherwise poor diet. A few cases of phrynoderma and stomatitis were observed. The low incidence of phrynoderma associated with a low fat and carotene intake in Assam would appear to indicate that these two dietary factors were not involved in this condition. It should be mentioned, however, that the skin of the children in this area was distinctly dry both to appearance and to touch. In the Bengal rural area and in Calcutta where the vitamin A and carotene intake was 3,500 IU and 7,000 IU per c.u. respectively, no cases of xeropthalmia or Bitots spots were observed. The incidence of malocclusion of teeth, the etiology of which is obscure, was highest in Assam, namely 23·2 per cent. and least in Calcutta 8·0 per cent. On the other hand the incidence of enlarged tonsils was greater among the well-to-do group, namely, 42·3 per cent. and least among the coolies, namely, 12·8 per cent. The incidence of caries was also least in Assam 11·1 per cent. and highest in the rural area 27·9 per cent., while the Calcutta group occupied an intermediate position, namely, 19·2 per cent. A low calcium diet does not appear to have favoured the incidence of caries. There appeared to be no relation between caries and malocclusion of teeth. Condition of malnutrition as judged by A. C. H. index was present amongst 38·7 per cent. boys in Assam, 33·8 per cent. in rural Bengal, and 16·3 per cent. in Calcutta. These figures, however, fell with the rise in economic status. The index picked out over 50 per cent. of children suffering from xeropthalmia and Bitots spots.

These surveys show that Assam coolies live on a diet which is inadequate qualitatively and probably also quantitatively. The same applies to a lesser extent to the agricultural community in Barasat, Bengal. In spite of this however the inherent vitality as judged by the percentage rate of growth and grip per lb. body-weight appeared to be good. The average number of children alive per family was 1·8 in Assam, 3·5 in rural Bengal, and 4·2 in Calcutta. In none of the groups were children sent away elsewhere, indeed in Assam they obtained employment in the industry from the age of seven.

An increase in the cultivation of green vegetables and consumption of *dals* among the poorer class would be a cheap and simple expedient at least to prevent the appearance of the xeropthalmia.

Survey in Ferozepore, Punjab.—The families surveyed included Hindus, Muslims, Sikhs of the artisan class, and a small group of sweepers. The diet of this mixed group was almost as good as that of the well-to-do people in Calcutta with regard to the calories, proteins, and fat. Even the sweeper class were on a much better diet than the Assam coolies. Their main cereal was wheat and the average milk available for consumption was about 8 oz. per head per day. In spite, however, of their better diet, particularly as regards calcium, the incidence of caries was over 30 per cent. The number of those with enlarged tonsils was also high. The average heights and weights of the children were above those of the Assam and rural Bengal groups. About 10 per cent. were well nourished as judged by A. C. H. index.

Vitamin Assay Flavine and B_6 (antidermatitis factor).—Using the methods referred to in last year's report, the estimation of the flavine content of some 90 and the B_6 vitamin content of 30 Indian foodstuffs was completed. Pulses and leafy vegetables were found to be relatively rich and fruits poor sources of this substance. As regards vitamin B_6 pulses, cereals and fish gave the best yields.

Biochemical Changes in the Blood in Anæmias.—Reference was made last year to an investigation into two types of hæmoglobin in connection with anæmias. Estimation of glutathione was added to these studies. The evidence so far indicates that the percentage of alkali resistant hæmoglobin varies between 8 and 17 per cent. in normal subjects and little or no variation occurs in the anæmia of either hyperchromic or hypochromic type. In this respect these types of anæmia differ from pernicious anæmia in which reduction and disappearance of the alkali resistant type has been recorded. The glutathione content of the blood appeared to vary with percentage hæmoglobin. Further studies on anæmias to include the estimation of hæmoglobin by (1) colorimetric, (2) iron content, (3) oxygen capacity methods are being taken up.

Epidemic Dropsy.—Dr. Bashir Ahmad in collaboration with the Director, Dr. R. B. Lal, carried out estimations of allylisothiocyanate content of certain samples of mustard oil in connection with the latter's studies on epidemic dropsy. No evidence to suggest any ætiological relationship of this substance with the disease was obtained.

Basal Metabolism of Indian Boys.—The basal metabolic rate of some sixty poor class Indian boys between ages 6 and 16 was investigated. The values, although on the low side fall within the two American standards, namely, Du Bois and Benedict. The conclusion arrived at was that the slightly lower rate was probably due to the low protein dietary rather than the racial difference.

Experimental Production of Cataract.—Attempts were made to produce cataracts in rats by feeding them with different foods. Best results were obtained with modified Sherman and Spohn diet, but even with this the percentage of success was only 25. Once produced it could not be cured by the administration of yeast or marmite which cleared up the dermatitis that appeared in some animals. No case of cataract however was associated with dermatitis. It is concluded that cataract is associated with a deficiency of one of the vitamins of the B group other than B_1 flavine or B_6 (anti-dermatitis factor).

Excretion of Vitamin B_1 in Human Urine.—The daily excretion of vitamin B_1 was studied in five normal healthy subjects fed on different diets. It varied between 6·4 per cent. to 12 per cent., and considering the previous dietetic history of the subjects, it varied in general in proportion to the amount ingested. There was, however, some evidence to show that the excretion of B_1 (total calorie and B_1 intake being kept constant) was much lower in those taking a carbohydrate diet than those on a fat rich diet. This would suggest the possibility that the metabolism of carbohydrates demands a greater amount of B_1 than that of fats.

The usual course of lectures and demonstrations was delivered to the D. P. H. students. One student took a three months' special course in biochemistry.

Dr. Bashir Ahmad, the Assistant Professor, proceeded on a Rockefellor Fellowship on the 24th September 1937. Having secured an appointment in Glasgow University and the Royal Hospital for Sick Children, I tendered my resignation in October.

As I am giving up this appointment, I should like to take this opportunity of giving a resume of the work carried out and an appreciation of the help received since this department was initiated. In 1934, I considered that the main policy of the laboratory should be a survey of physique of children, diet survey and food analysis. The prosecution of this work was helped by grants from the Indian Research Fund Association and received further impetus when the Nutrition Advisory Committee was formed in 1936. In all those investigations, I have received the active and full co-operation of Dr. Bashir Ahmad who has taken a part in nearly every problem in which this laboratory was concerned. I am also indebted to Dr. R. B. Lal, the Director, and to others in the Institute for assistance in connection with different inquiries. I should also like to express my appreciation for the generous facilities which have been given to me by Bt.-Col. R. N. Chopra, Director of the School of Tropical Medicine, for carrying out clinical work in connection with different diseases in the wards of the Carmichael Hospital for Tropical Diseases.

The following papers were published during the year:—

The transformation of carotene into vitamin A in liver autolysates (1937). *Ind. J. Med. Research.*

Some observations on the experimental production of cataract (1937). *Ind. J. Med. Research, 1937, 25, 547.*

The Bisulphite binding power of the blood in cases of epidemic dropsy, anæmia and malaria and its possible bearing on a vitamin B deficiency. *Ind. Med. Gazette, 1937, LXXII, 147.*

A diet and physique survey in Assam, rural Bengal, and Calcutta. *Ind. J. Med. Research (in press).*

The flavine and vitamin B_6 content of Indian foodstuffs. *Ind. J. Med. Research (in press).*

Observations on the Basal Metabolism of Indian boys in Calcutta. *Ind. J. Med. Research (in press).*

A diet survey of fifty-one families of Ferozepore, Punjab. *Ind. J. Med. Research (in press).*

REPORT OF THE PROFESSOR OF MALARIOLOGY AND RURAL HYGIENE.

(Dr. K. V. Krishnan, m.b.b.s., m.r.c.p., d.b., d.sc.)

Staff.—There was no change in the personnel of the department. The additional staff asked for in order to develop the scope and usefulness of the tuberculosis section has not yet been sanctioned. This has greatly hampered the progress of this section with respect to teaching and research in tuberculosis. Enquiries from medical graduates for training in the public health aspects of tuberculosis are being received every year but it has not been possible, so far, to arrange for a three months course on the subject. Institution of a special three months course will meet a genuine demand.

Teaching.—The usual lectures and demonstrations on the public health aspects of malariology, venereal diseases and tuberculosis and other communicable diseases were given to the D. P. H. and D. P. H. & Hy. students. A series of special lectures on tuberculosis was given to the post-graduate students undergoing training in tuberculosis under the auspices of the King George Thanks-Giving (Anti-Tuberculosis) Fund. A malaria exhibition was organised for the benefit of the large number of medical men who had assembled in Calcutta in connection with the All-Bengal Provincial Medical Conference. It gave them an opportunity to acquaint themselves with the recent developments in malariology. The exhibition lasted for two days. A number of lectures and demonstrations by prominent malariologists of the city were also arranged and these were greatly appreciated.

The department actively co-operated in organising a malaria symposium under the auspices of the National Institute of Sciences of India.

Research.—A brief summary of the investigations conducted and the results obtained during the year are presented below.

Treatment of Blackwater Fever.

In last year's report the results of investigation on the ætiology of blackwater fever in man and of hæmoglobinuria in monkeys were presented. These results indicated that the mechanism of hæmolysis in both these conditions was somewhat similar and that in both of them certain changes in the blood and tissues were frequently met with. Briefly stated, these changes include focal necrosis of the liver, degeneration of the adrenal cortex specially of the zona fasiculata, an excessive production of unsaturated fatty acids, a lowering of free-cholesterol and a hypofunction of the reticulo-endothelial system. Attempts were made to correct these pathological changes and to see how far that would influence the incidence of hæmoglobinuria. Treatment of monkeys with glucose, ascorbic acid and cortin gave fairly satisfactory results. During the year under review this line of treatment was extended to human cases of blackwater fever. In all seven cases were treated and all of them completely recovered.

The cortical extract used in the treatment was of two types—one a commercial preparation obtained from the Wilson Laboratories in Chicago, and the other an extract prepared in our own laboratory according to the technique of Swingle and Pfiffner. Both extracts gave equally encouraging results. The dose used for human cases was 1 c.c. of the extract (equivalent to 1/10th grm. of fresh gland tissue) twice a day or oftener for about 3 to 5 days depending upon the severity of the hæmoglobinuria. The ascorbic acid used was obtained from the British Drug House Co., and was administered in 100 mgm. doses twice a day. It was given intravenously in saline or by mouth according to the condition of the patient. Glucose was given as a 5 per cent. solution in saline intravenously, one pint being given at least twice a day. In addition to this line of treatment in all febrile cases and in those showing malarial parasites in their blood atebrin was administered to control the fever.

It was observed that this line of treatment invariably led to the following beneficial results:—

(*a*) A marked diminution in the intensity of hæmoglobinura. The urine cleared up within one to three days.

(*b*) An increase in the quantity of urine passed. Anuria, if present, was overcome.

(*c*) Rapid recovery from collapse that is invariably present and improvement in the general condition of the patient; these changes were noticed within 24 hours of the commencement of the treatment.

(*d*) Complete recovery of all the seven cases treated.

The mode of action of cortin was also investigated. The evidence obtained suggested that its action was of twofold nature, namely, (1) detoxicating and (2) causing an alternation in the ratio of free to ester cholesterol through its action on cholesterol metabolism. As regards the mode of action of ascorbic acid, it probably supplies a deficiency that is met with in blackwater fever and also stimulates the reticulo-endothelial system. The injections of glucose saline probably act by combating collapse, correcting anuria and preventing liver damage.

Although the number of human cases treated so far is small the results obtained seem to be encouraging. It is not claimed that the line of treatment recommended is the last word in the treatment of blackwater fever; but it is believed that it is better than any other line of treatment so far employed and that it is worthy of an extended trial.

The rôle of ascorbic acid in Malaria.—In view of the very interesting results obtained in the treatment of blackwater fever by the use of ascorbic acid, the rôle of vitamin C in malaria is at present under investigation. Although it is premature to draw any definite conclusions from the results so far obtained it appears that they will be of interest from the therapeutic point of view. It has been found that during the malarial paroxysm the body excretes vitamin C in considerable amounts and that as a result of repeated attacks of malaria a condition of subclinical hypo-vitaminosis develops. In view of the important relationship between vitamin C and the reticulo-endothelial system which is alleged to play an important part in immunity and cure of malaria it is possible that the results of this investigation may throw

some light on the rôle of vitamin C in the cure of malaria and in the prevention of relapses.

Rôle of antibodies in Kala-azar.—While there is evidence to show that in some protozoal infections antibodies play an important part in cure, in others they appear to be of little or no importance. In trypanosome infections antibodies have been shown by Taliaferro and others to have lytic and antireproductive properties and to help materially in the cure of the disease. On the other hand in the closely allied infection, namely, kala-azar, the rôle of antibodies is not yet clearly understood. Experiments were conducted to find out if the administration of specific antibodies against *Leishmania donovani* would in any way modify the course of leishmania infection.

Mice were used as experimental animals. Specific antibodies against *Leishmania donovani* were obtained from two sources, namely, (1) from rabbits by immunising them with a vaccine of the organism, and (2) from kala-azar patients after specific treatment and cure (convalescent serum). Experiments, both *in vitro* and *in vivo*, were performed. Saline emulsion of spleens of heavily infected hamsters was inoculated intraperitoneally to produce leishmania infection in the mice. The results obtained are summarised below:—

(1) That fresh normal serum, kala-azar serum (from untreated kala-azar cases) and convalescent serum from cured cases are all lytic to leishmania flagellates *in vitro*.

(2) When these sera are heated to 56° C. for one hour their lytic property is lost in every case.

(3) Prophylactic administration of leishmania vaccine fails to protect mice against subsequent leishmania infection despite the fact that their serum contains specific antibodies.

(4) Prophylactic administration of convalescent serum from cured kala-azar cases or of anti-leishmania rabbit serum fails to protect mice against subsequent leishmania infection.

(5) Repeated administration of these anti-sera to infected mice fails to bring about cure.

(6) Repeated administration of mixtures of Neostibosan and anti-serum to infected mice also fails to effect a cure.

From these observations it appears that antibodies to leishmania have a lytic action on the parasites only *in vitro*. Their presence *in vivo* does not appear to help materially in the cure. This may be so because the leishmania in the host are present intracellularly within phagocytic cells and it is possible that these cells afford the parasites a certain degree of protection against the injurious action of antibodies. Therefore one is led to surmise that in the process of cure of leishmania infections factors other than antibodies will also have to be taken into account.

Anopheles culicifacies in Bengal.—In the last year's report reference was made to preliminary studies on the inability of *Anopheles culicifacies* to establish itself permanently in villages in Bengal and to play a part in malaria transmission despite its repeated introduction every year through canal water. These studies have shown that the

temperature and humidity conditions as well as the chemical composition of water in the breeding places were the factors responsible for this phenomenon. These observations were extended during the year under review. The prevailing conditions as regards the factors referred to above were investigated and it is believed that a satisfactory explanation of the observed facts has been found.

This species of mosquito is introduced into Bengal villages in larval form during late winter and early spring. During this period the temperature of the water in the breeding places ranges between 80·6° F. and 84·2° F. and the ratio of dissolved CO_2 to O_2 is low (CO_2 being less than 0·2 part per 100,000 parts and O_2 0·6 part per 100,000 parts). These conditions are favourable for larvæ. But as regards the conditions for adult life they are only partly favourable. While the temperature is favourable being about 80° F. to 90° F. maximum and 70° F. to 80° F. minimum the humidity is unfavourable being low, between 24 to 48 per cent., the low humidity probably leads to the premature death of many of the adults. Our finding that while larval catch is profuse adult catches are few lends confirmation to it. These together with the fact that the species is introduced into the villages during the non-malarial season probably explain the failure of the species to play a part in malaria transmission. Later in the year particularly during the malarial season when the humidity and temperature become favourable for the adult mosquitoes conditions for larval breeding of this species become unfavourable chiefly due to the changes undergone by the water of the breeding places as a result of the rains. Not only does the temperature of the water in the breeding places go up to 90° to 95° F. but also the ratio of CO_2 to O is reversed, the former being greatly increased (1 part per 100,000) and the latter diminished (below 0·6 part per 100,000). These conditions make it difficult for culicifacies larvæ to breed. But they are favourable for the breeding of species like *Anopheles philippinensis*. It is therefore the latter species that is responsible for malaria transmission in the Bengal villages. The point of interest brought out by this study is that for controlling breeding of *Anopheles culicifacies* in rural areas in certain instances at least, naturalistic methods such as herbage cover, etc., may be found more economical and successful than other methods. Therefore whenever this species is a predominant carrier of malaria it is desirable to try naturalistic methods of control for bringing about the necessary chemical alteration to inhibit breeding. What happens naturally in Bengal may be artificially produced in other rural areas and *Anopheles culicifacies* prevented from acting as a carrier.

Exacerbation of malaria in Field Centre.—The periodical surveys conducted during the year showed that the malarial incidence in the field centre this year was unusually high compared to the previous three years. On investigating the cause of this sudden exacerbation and on analysis and study of the available records for the previous years it was found that the increase in malaria was in all probability attributable to the unusual rainfall that occurred this year during the usually dry month of February. Although there was no marked difference in this year's total rainfall from that of other years, the distribution of the rainfall in the different months showed striking variation. As against a normal rainfall of less than 1″ in February there was precipitation of 4″ to 5″ this year. This early heavy rainfall during the

dry months led to early breeding of the carrier species *Anopheles philippinensis*. Adults began to appear in March instead of in July and continued till the monsoon rains set in. With the onset of the rains the breeding of the species greatly increased and there was an exceptionally high prevalence of adults during the malaria season between July to October. The sporozoite rate was also strikingly high and consequently the malaria incidence. The parasite index, the percentage of gametocyte carriers, as well as the number of gametocytes per cmm. all increased markedly, and continued to do so over a longer period than usual. A reference to the previous malarial history of the area revealed that such periodic increase in malaria prevalence does occur once in every 4 or 5 years. On studying the rainfall figures it was found that like this year the increase in malaria was associated with unusual rainfall during the drier months. In the years of increased malaria incidence this factor therefore appears to be of considerable importance and will have to be taken into account in forecasting the rise of malaria in certain parts of Bengal. Whenever after two or three years of normal conditions there is unusual rainfall in the dry months, a rise in malaria incidence may be predicted and expected.

A study of the relative incidence and intensity of malaria in people of low and high economic status.— During the last three years the relative intensity of malaria in people of different economic status living in our field centre was investigated. Analysis of the data suggested at first sight that both the spleen and the parasite rates were higher in people of low economic status than in people of high economic status. But a more detailed scrutiny of the question revealed that in almost all cases these differences could be explained better on other basis, such as the nearness or remoteness of the dwellings of these people to breeding places of the carrier species and the degree of exposure to their bites, etc. Differences in economic status failed to explain the findings in all cases. Under identical conditions people of low and high economic status suffered equally from the disease. In certain instances high incidence of malaria occurred among richer classes and a low incidence in the poorer classes. If one or the other suffered more or less in certain blocks it could be better explained on the basis of the presence of breeding places of the carrier species close to their dwellings and on the degree of exposure to the bites of the mosquitoes. These factors evidently played a more important part than the economic status.

Epidemiological studies in human Blackwater Fever.— The history sheets of the cases of blackwater fever admitted into the various hospitals in Calcutta city within the last ten years were studied. Interesting data relating to the clinical, epidemiological and therapeutic aspects have been obtained. These are being analysed and the results will be presented when the work is completed.

For help and co-operation received, I wish to express my thanks to Lt.-Col. A. C. Chatterjee, Director of Public Health, Bengal, Bt.-Col. R. N. Chopra, Director, Calcutta School of Tropical Medicine, Dr. L. E. Napier, Professor of Tropical Medicine, Calcutta School of Tropical Medicine, Dr. A. K. Sen, Director, Bengal Public Health Laboratory, Dr. A. K. Sircar, District Health Officer, Faridpur, and the Superintendents of Medical College Hospital, Campbell Hospital, Carmichael

Hospital, Sambhunath Pandit Hospital, and Presidency General Hospital, Calcutta.

Papers published during the year:

(1) Immunity in Protozoal infections. *Indian Science Congress.*

(2) Treatment of Blackwater Fever. *Ibid.*

(3) The Rôle of Antibodies in Kala-azar. *Ibid.*

(4) The Mechanism of Hæmolysis in Blackwater Fever. *Ibid.*

(5) Spleen and Resistance. *National Institute of Science* (Malaria Symposium number).

(6) Biochemical changes and their Significance in Blackwater Fever. *Ibid.*

REPORT OF THE MATERNITY AND CHILD WELFARE SECTION OF THE ALL-INDIA INSTITUTE OF HYGIENE AND PUBLIC HEALTH FOR 1937.

(Dr. M. I. Neal-Edwards, M.D., W.M.S.)

The maintenance of the Section including the Welfare Centre was taken over by the Government of India on April 1st, 1937. Pending the appointment of a professor the services of the Women's Medical Service Officer previously acting in that capacity were lent for a further period and Dr. Pandit, temporary officer of the Women's Medical Service, continued to act as senior research assistant to the Indian Research Fund Association enquiry which was being carried on in the department.

Teaching.—*D. M. C. W. Course:* One student who was deputed from the Women's Medical Service Training Reserve, took the course during 1936-37 and was awarded the diploma. Two students began the course in 1937 but one has since resigned.

The hospital facilities available in Calcutta for this post-graduate course are at present inadequate. The need is for a hospital in which are provided wards and out-patient clinics for children's diseases, venereal diseases and antenatal and postnatal care where post-graduate experience can be gained and where specialised teaching is given. As it is at present much of the time spent in the first three months of the course which should be so valuable, is wasted by going from one institution to another for various facilities which even then are not organised to meet the needs of the post-graduate.

D. P. H. Course: The usual lectures and demonstrations in Maternity and Child Welfare and School Hygiene were given to the students doing this course.

The Maternity and Child Welfare Centre.—No changes in the staff took place when the Welfare Centre was taken over by the Government of India and became an official part of the Maternity and Child Welfare Section. There was, however, considerable delay in the appointment of the midwives owing to the impossibility of getting suitable candidates for the posts at the salary offered at first. The work of the centre has been carried on as in previous years and its steady growth is resulting in the accumulation of very useful data.

The records which are accumulating in the centre are beginning to provide some interesting information.

The incidence of rickets.—In 308 children who were under the care of the Welfare Centre from the first to the third year of life the incidence of rickets was found to be 24 per cent. amongst Hindus and 11 per cent. amongst Mohammedans. Considering Hindus by province of origin the highest incidence was found amongst Gujeratis (35 per cent.) and Marwaris (30 per cent.). The incidence amongst Bengali Hindus was considerably lower (10 per cent.). Comparison of the diets and habits of the mothers and children in the different communities should throw some light on the responsible factors.

Blood pressure in pregnancy.—In a study of 386 healthy women examined in pregnancy the systolic and diastolic blood pressure was found to be somewhat lower in multiparæ than in primigravidæ. There was also noticed to be a slight tendency for blood pressure rise towards the end of pregnancy (no case showing albuminuria was included).

The mean systolic blood pressure of 143 healthy multiparæ in the first half of pregnancy was 105 mm. Hg. and the diastolic 66 mm., while in 130 women in the last month of pregnancy the mean was 109/70 mm. In 24 primigravidæ in the first half of pregnancy the mean was 111/67 mm. and in 19 primigravidæ in the last month of pregnancy 115/73 mm.

The mean duration of normal labour in 82 multiparæ delivered in

A report of the work of the Centre will be found on page 45, but the following are some of the figures for the year.

1,000 infants put on carts during 1937. The infantile mortality rate of infants in the district was 215 per total live births.

There were 475 toddlers on cards at the end of 1937, of whom 202 or 42 per cent. attended the centre. There were 16 deaths of toddlers on cards, a mortality of 33 per 1,000.

The total clinic attendances of antenatal and postnatal cases, infants and toddlers during the year was 8,950, an average weekly attendance of 172. A total of 5,978 home visits were paid by the two health visitors, an average of 249 home visits by each health visitor per month.

The Nursery School was carried on at the Centre during the year and the average daily attendance was 13.

Clive Jute Mills Maternity and Child Welfare.—This welfare centre is provided by the Mill authorities for the benefit of the women workers.

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.—1. *Urban Statistical enquiry into the causes of ality in Calcutta:* A statistical enquiry into the causes ortality was carried out in Calcutta for a period of a of maternal deaths were collected from all registered registered in the area under the control of the Health ration of Calcutta. Duplicate registration cards were e case of all female deaths between these ages and on es information was provided regarding the existence of the puerperal state. Considerable care was taken to ensure registration cards were received in all cases, but ques- to pregnancy were not answered in every case and the rnal deaths cannot therefore be claimed to be quite

rnal death was followed up by means of home visits, h the doctor, midwife or dai who attended at the time of visits to institutions in which treatment had been given. mation collected was in most cases sufficient to make it possible to reach a conclusion regarding the probable cause of death and the contributing factors, and also regarding the preventibility of the death.

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The mean systolic blood pressure of 143 healthy multiparæ in the first half of pregnancy was 105 mm. Hg. and the diastolic 66 mm., while in 130 women in the last month of pregnancy the mean was 109/70 mm. In 21 primigravidæ in the first half of pregnancy the mean was 111/67 mm. and in 19 primigravidæ in the last month of pregnancy 115/73 mm.

The mean duration of normal labour in 82 multiparæ delivered in the homes was found to be 9 hours 11 minutes and for 17 primiparæ, 14 hours 7 minutes. The mean duration of the third stage of labour was 10 minutes for both groups.

Previous obstetrical histories of 414 multiparæ attending the centre provided the following information:

A total of 1,615 previous pregnancies had resulted in the birth of 1,372 living children (one pair of twins), 71 stillbirths and 173 abortions. This gives a stillbirth rate of 51·75 per 1,000 live births and an abortion rate of 126 per 1,000 live births.

The number of children born alive and still living at the time of report was 877 or 63·92 per cent. of the total live births. These facts relate to incompleted families, for the women were again pregnant when the above histories were taken.

The Welfare Centre staff under the capable leadership of the Senior Health Visitor, Miss Balwant Kaur, have done excellent work throughout the year and the increasingly heavy clinic work and home visiting have been undertaken with energy and enthusiasm.

~~A report of the work of the Centre will be found in the appendix; the following are some of the figures for the year.~~

Antenatal care.—There were 484 women under antenatal care, 349 or 72 per cent. of whom attended the centre. Of these 251 antenatal cases were delivered in the district during the year and 75 or 29 per cent. were confined by the Welfare Centre staff. There were 3 maternal deaths in cases put on antenatal cards, a maternal mortality rate of 11·9 per 1,000 deliveries. The maternal mortality rate in the whole district (Half Ward 8) was, from the information available, 19·6 per 1,000 live births.

Infant and Child care.—There were 459 infants born in the district whose births were registered or found in the course of visiting during the year. Of these 55 had died or left the district before being visited and 5 others refused the visit of the Health Visitor; there were 70 infants who came to the district after birth, giving a total of 469 infants put on cards in 1937. Including infants carried over from 1936 there was a total of 773 infants under care during the year. There were 52 deaths of infants on cards, and infantile mortality of 111 per 1,000 infants put on cards during 1937. The infantile mortality rate of infants in the district was 215 per total live births.

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The total clinic attendances of antenatal and postnatal cases, infants and toddlers during the year was 8,950, an average weekly attendance of 172. A total of 5,978 home visits were paid by the two health visitors, an average of 249 home visits by each health visitor per month.

The Nursery School was carried on at the Centre during the year and the average daily attendance was 13.

Clive Jute Mills Maternity and Child Welfare.—This welfare centre is provided by the Mill authorities for the benefit of the women workers.

The main feature of the work is a crêche in which 60 children between the ages of 3 months and 5 years are cared for during the mothers' working hours.

A weekly clinic is held for the examination of the children and of antenatal and postnatal cases and detailed records are kept of the children's progress.

A high proportion of premature and underweight babies are born and a marked slowing of the infants' rate or gain in weight is usually observed when the mothers return to work after delivery. This slow gain persists even when the child is able to take ordinary mixed diet.

Various additions to the home diet of the children are provided. Each child (except the younger infants) receives daily 4 oz. cow's milk and about 4 oz. suji in the morning and 4 oz. skimmed milk in the evening. Twice a week vegetable or liver or vegetables or bone soup are given in addition and on other days fresh fruit, biscuits or sprouted gram. It seems likely that quantitatively the total food intake of these children is still insufficient for satisfactory progress and it is proposed to observe the effect of giving a morning meal of *khichri* or *chapatti* and vegetables.

Research.—1. *Urban Statistical enquiry into the causes of maternal mortality in Calcutta:* A statistical enquiry into the causes of maternal mortality was carried out in Calcutta for a period of a year. Cases of maternal deaths were collected from all registered female deaths registered in the area under the control of the Health Officer, Corporation of Calcutta. Duplicate registration cards were supplied in the case of all female deaths between these ages and on these duplicates information was provided regarding the existence of pregnancy or the puerperal state. Considerable care was taken to ensure that duplicate registration cards were received in all cases, but questions relating to pregnancy were not answered in every case and the series of maternal deaths cannot therefore be claimed to be quite complete.

Each maternal death was followed up by means of home visits, interviews with the doctor, midwife or dai who attended at the time of delivery, or visits to institutions in which treatment had been given. The information collected was in most cases sufficient to make it possible to reach a conclusion regarding the probable cause of death and the contributing factors, and also regarding the preventibility of the death.

But in some cases these conclusions were largely conjectures based on the statements of relatives, for in 11 per cent. of the maternal deaths investigated no trained person had been in attendance.

During the year of the enquiry 887 maternal deaths were investigated. The findings have been analysed and the report has been prepared and submitted.

The following are some of the figures. The series of deaths has been divided into two classes:—

Class I.—Deaths due directly to childbearing: 701 cases.

Class II.—Deaths due to diseases associated with childbearing: 186 cases.

The cases of death due to childbearing were classified further under the headings of the International List (1929 revision) with an added heading for anæmia.

TABLE.

Deaths due directly to childbearing.

Distribution by causes.

		Per cent.
1. Septic aborption	33	4·71
2. Abortion (non-septic)	4	0·57
3. Ectopic gestation	6	0·86
4. Other accidents of pregnancy	7	1·00
5. Puerperal hæmorrhage	74	10·56
6. Puerperal sepsis	224	31·95
7. Puerperal alb. & convulsions	126	17·97
8. Other toxæmias of pregnancy	15	2·14
9. Embolism and sudden death	11	1·57
10. Other accidents of childbirth	26	3·71
11. Other or unspecified conditions of the puerperal state	10	1·43
12. Anæmia	165	23·53
	701	100·00

Puerperal sepsis, anæmia and eclampsia stand out as the most important cause of death due directly to childbearing in Calcutta while pulmonary tuberculosis was responsible for 40 per cent. of deaths from diseases associated with childbearing.

The importance of anæmia was greater than appears from the table, for in addition to those deaths from anæmia *per se*, there were many others, specially in the sepsis group, in which anæmia was an important contributing factor. Very little information was forthcoming regarding the etiological factors and the types of anæmia responsible for this high mortality and further study of this problem in Calcutta is greatly needed.

Preventability: An attempt has been made to assess the avoidable factor in this series of maternal deaths. Difficulties arose in connection with the standards which should be adopted for an Indian City.

The findings which are put forward with considerable hesitation showed that is only 3·7 per cent. of cases relevant to this part of the enquiry were all the adopted standards satisfied and in 96·3 per cent. there was an avoidable factor present.

Conclusions regarding the influence of factors affecting mortality, *e.g.*, community, age, gravidity, economic status, overcrowding, attendant at delivery have been considerably limited by lack of data for comparison. The only figures available were the community distribution of registered births during the period of the enquiry.

The second part of the report consists of a detailed analysis of the deaths under the International List division by cause.

2. *Anæmia Enquiry:* The importance of determining the forms of anæmia which are responsible for the high maternal morbidity and mortality rate from this cause in Calcutta was brought out by the maternal mortality enquiry.

The present enquiry has been undertaken with the object of collecting information regarding etiological factors, *e.g.*, diets, economic conditions, purdah, personal history and associated diseases, in a series of moderately and severely anæmic women attending the welfare centres, maternity homes and antenatal clinics in Calcutta. It is hoped to demonstrate by means of blood examination at intervals in pregnancy and after delivery, the types of anæmia which occur and the effect of pregnancy and lactation on the course of the anæmia.

Control Series: It has been found necessary to collect a control series of specimens of blood from healthy Indian women in order that the normal range of absolute values (mean corpuscular volume, mean corpuscular hæmoglobin and mean corpuscular hæmoglobin concentration) may be available for comparison. This is being carried out in association with Dr. Napier's department at the School of Tropical Medicine. The findings so far collected suggest that the blood of healthy Indian women conforms to accepted European hæmatological standards.

Each case of anæmia and pregnancy needs to be followed up for several months and large number of cases must be collected before any conclusion can be drawn regarding the influence of etiological factors.

In 161 antenatal and 12 puerperal women examined there were 77 cases of macrocytic anæmia, 41 cases of microcytic anæmia and 55 cases of normocytic anæmia. Of the 77 cases of macrocytic anæmia only 23 were hyperchromic, the remaining being normo- and hypo-chromic according to European standards.

There were 40 cases of severe anæmia (less than 50 per cent. Hellige) and of these 18 were macrocytic, 12 microcytic hypochromic and 10 normocytic normo- or hypo-chromic. The 18 macrocytic cases included only 7 with hyperchromia, the remaining being normo- or hypo-chromic according to European standards. In the series of 18 severe macrocytic anæmias there was a history of malaria in 6 cases although no parasites were found in any case. The spleen was enlarged in 10 cases and an indirect positive Van den Bergh reaction was obtained in 12 cases.

N.B.—The Annual Report of the Welfare Centre, containing an outline of the organisation and activities of the scheme and notes on statistical and other findings resulting from an analysis of the antenatal, obstetric, infant and the pre-school child record cards, is presented as an appendix to this report. On Page (

REPORT OF THE CHOLERA INQUIRY.

(Dr. R. W. Linton.)

During the past year this Inquiry has worked on the subjects of variation and polysaccharide structure.

1. **Variation in single-cell cultures.**—This work was undertaken to see if the same types of variation occurred in strains descended from a single cell, and therefore of accurately ascertained chemical structure, as in whole cultures obtained in the ordinary way, and therefore possibly of mixed chemical structure (*cf.* Linton et al. Ind. Jour. Med. Res., XXII, No. 4, April, 1935, p. 633). It was found that the same changes did occur, indicating a chemical basis for the variations previously reported in these organisms.

The experiments were begun with a culture descended from a single cell and having a certain set of characteristics: biochemical, cultural, serological, and a certain chemical structure. At the end of the experiment there had been produced from this culture a new strain, having another set of biochemical, cultural and serological characteristics, and a different chemical structure. It followed that the new strain fell into a different chemical group from the old, and it should be strongly emphasized that all the characteristics of the new strain were similar to those of the chemical group into which it now fell. In other words, the changes in chemical composition, biochemical reactions, cultural and serological properties are correlated.

Although almost nothing is known about the internal arrangements of the vibrios, it may perhaps be permissible to suggest that each of them possesses the enzymic equipment capable of synthesizing the various proteins and polysaccharides which are found in the whole group; that during the course of synthesis and growth sometimes one and sometimes another of these constituents is formed; and that as a result of this shifting in the direction of synthesis a new type of organism is produced which gives rise to a strain different in character because it is different in chemical composition from the parent strain. Since in these experiments all the cells were descended from one cell, and yet were capable of giving rise to variants, it is difficult to account for our observations on any other basis.

2. **Structure and serology of vibrio polysaccharides.**—This work has involved the isolation in very pure form of the three types of vibrio polysaccharide, their analysis, and the study of their precipitin reactions. The techniques necessary to isolate polysaccharides differ according to the kind of bacterium being worked with, and as very little was known about vibrio polysaccharides, it was necessary for us to develop new methods and modifications of old ones, in order to arrive at pure products capable of being analyzed and used serologically. After the methods had been perfected, in itself a matter of several months study, the vibrios were analyzed according to the following scheme:—

(I) Strains freshly isolated from cases during the epidemic. These strains belong to chemical groups I and II, and

their polysaccharides have the following properties: their solutions in water are low in viscosity, and their specific rotations range from +80° to +85°, nitrogen values are high, from 4 per cent. to 9 per cent., while the acetyl values are low at about 1 per cent. Maximum hydrolysis is only 45 per cent. On the addition of acid to the aqueous solution of these polysaccharides, a very deep opalescence develops which precipitates when heated on the water bath. This precipitate is lipoidal and ether-soluble, and may be analogous to the lipoid-containing structures found in other intestinal bacteria. It is difficult to prepare antisera in this group of organisms which will react at high titres in the homologous precipitin reaction. After long-continued injections, titres of 1 : 250,000 to 1 : 12,000,000 are obtainable. The antisera and polysaccharides of the whole group show marked cross-reactions.

(II) Strains freshly isolated at the end of an epidemic. The strains of this group belong entirely to chemical group II. The polysaccharides here are similar in appearance to those of the previous group, but nitrogen values are lower at 3 per cent. and acetyl values higher at 2·5 per cent. to 3·0 per cent. Hydrolysis is 60 per cent. There is only a slight opalescence on the addition of acid to the aqueous solution of the polysaccharide. High precipitin titres of 2-4 million are readily obtained by injecting the homologous organisms into rabbits.

(III) A laboratory variant strain, chemical group VI. The dried polysaccharide appears as fibrous as a piece of filter paper, and gives a very highly viscous solution in water. The specific rotation varies from 53° to 63° in various preparations, nitrogen is from 2·5 per cent. to 3·5 per cent. and the acetyl value is high, varying from 8·5 per cent. to 13·4 per cent. Hydrolysis is about 60 per cent. It is easy to prepare an antiserum against this organism which will have a titre of 1 : 16,000,000 against the homologous polysaccharide.

To summarise: from groups I to III there is an increase in serological reactivity, acetyl groups, viscosity in aqueous solution, percentage hydrolysis, and ease of preparation of a serum having a high precipitin titre. There is a decrease in specific rotation, nitrogen percentage, and in the amount of the " lipoid complex ".

The present position in regard to the serology of these polysaccharides is that the type 3 (glucose-containing) sugar can be completely differentiated from the other two types by the precipitin test. Types 1 and 2, which are very similar chemically, as we showed in 1932, cross-react to a considerable extent, although these heterologous titres are generally lower than the cross-reactions within the group. It is to these cross-reactions that we are now applying the method of nitrogen analysis, which enables a quantitative statement to be made of the amount of reaction between any antigen and antibody. With this

information we should be able to determine exactly how much cross-reaction is occurring, in comparison with the homologous reactions.

In addition we are attempting the preparation of pure anti-polysaccharide sera by mixing the polysaccharides with ox serum and after allowing them to stand for a time, injecting the mixtures into rabbits. In this way we may be able to produce antisera against the polysaccharide alone and free from the complications present when antisera are also being produced against the protein portion of the vibrio. In these reactions we shall likewise use the nitrogen determination method.

REPORT OF THE TUBERCULOSIS INQUIRY, 1937.

(Financed by the Indian Research Fund Association.)

[DR. A. C. UKIL, M.B., M.S.P.E. (PARIS), F.S.M.F., F.N.I.]

This enquiry continues to elucidate the Epidemiology, Pathology and Bacteriology of Tuberculosis in India, besides devoting its attention to some cognate problems like the part played by solar radiation in influencing tuberculous infection in the tropics, the study of some non-tuberculous diseases which simulate pulmonary tuberculosis, etc. The work so far done indicates that the problems of tuberculous infection and disease in India differs in certain essential aspects from those in Europe and America. The work carried out in 1937 may be conveniently grouped under the following headings:—

I.—*Tuberculosis in relation to industry.*

It has been thought that industrialisation and urbanisation are probably playing a large part in the dissemination of tuberculosis in India. This enquiry has been undertaken to ascertain in what way the rural population of India are reacting to tuberculous infection on account of aggregation and dispersal in connection with industries. In order to find this out, we have to determine the incidence and character of tuberculous infection and disease among the population, to determine the nature of dust-hazards (*e.g.*, fibrosis of lung, bronchitis, allergic manifestations, etc.) which cause respiratory or other disability and to trace as many of the diseased (tuberculous) workers as possible to their homes in order to find out the extent of home infection, the method of spread of disease from the industrial areas to the village homes of workers and the degree of hypersensitiveness in them and their contacts.

A Jute Mill with a population of 5,299 workers, located 22 miles from Calcutta, has been selected for the investigation for the following reasons:—(1) the industry, being a monopoly of this part of the world, is an unexplored subject for study, (2) the mill has a population of 5,299 workers (3,980 males, 836 females and 483 children) hailing from almost all the provinces of India. Approximately two-thirds of them live in masonry barracks and the rest live in crowded insanitary bustees near the mill, thus offering a representative mixed population, presenting diverse conditions of sanitation and overcrowding, (3) it is a dusty industry likely to cause dust and other hazards, of which tuberculosis may be one and (4) the mill is the only one in the neighbourhood of Calcutta which has an X-ray installation and where the authorities are offering valuable co-operation.

Workers are being examined by sections (*e.g.*, batching, preparing, spinning, finishing, etc.) according to the degree of exposure to dust inhalation. The data collected for each individual include important details from the previous life of the worker, previous illnesses, history of contact and industrial hazard, age at entry, nature of work, duration, financial status, housing, etc. Besides a full clinical examination, every individual is tested with tuberculin, the chest is skiagraphed and

blood and sputum (if available) are examined. From these data evidences regarding the presence of (*a*) definitely active tuberculous lesions, (*b*) probably active tuberculous lesions, (*c*) arrested or healed foci, (*d*) other chest diseases and (*e*) diseases peculiar to the industry itself, are being obtained.

Up to date, 224 workers have been examined. Of these, 5 show " definitely active " lung tuberculosis, 11 " probably active " lesions, and 143 " arrested or latent foci ". In almost all cases the skiagraphs show greatly exaggerated bronchial striations and in some arborizations with small mottlings. The heart is found enlarged in many cases. Some workers show eczematous (? allergic) manifestations of the skin in the forearm and hands (? jute eczema).

It is proposed to examine a number of new entrants to industrial life, following the same technique as above and to follow them up in their industrial life, in order to study how they react to the new environment. Besides the examination of the mill workers in lines and bustees, home-surveys, both in mill and rural areas, are proposed to be conducted in as many cases as possible. The size, concentration and chemical composition of the dust in this industry will also be determined.

This is an entirely new line of work and we cannot at present foresee its future development.

II.—*Tuberculosis in " Home-Contacts ".*

A report on a study of 444 infants and children was given in the last year's note. A portion of the data has been published in a paper in the April 1937 Number of the Indian Medical Gazette. The number of cases examined up to December, 1937, was 648. In order to get a more dependable basis for opinion, it is proposed to increase the number of completely examined cases to 1,000.

Of the cases examined and followed up in 1937, 172 were contacts of " positive sputum " cases, 13 of " negative sputum " cases and 19 of " unknown sputum " cases. Of these 165 had ' intimate ' contact and 39 ' distant ' contact. Mantoux test was positive in 72·7 *per cent.* Active parenchymal lesions were detected by radioscopy in 5 per cent.; healed parenchymal lesions in 3·3 *per cent.* and definitely enlarged hilar glands in 30·8 *per cent.* of cases. Rest showed no radiographic lesions.

The percentage of positive tuberculin reaction was 100 *per cent.* in " active lesion " and " healed lesion " series, 70 per cent. in " tracheobronchial adenopathy " series and 75·3 per cent in the cases with " no detectable lesions ". Children in contact with " open " cases were found to be slightly more hypersensitive than those in contact with " closed " cases. As in last year, the percentage of positive tuberculin reaction was found to vary *directly* with age, while the incidence of demonstrable lesions varied *indirectly* with age. All the cases with active lesions were below 10 years of age and almost all the cases with healed lesion above this age period. The incidence of infection, as detected by Mantoux test, was found to be 33·6 per cent. higher than that detected by radioscopy.

Home survey revealed that a majority of cases belonged to the poor classes, that 45 per cent. of them were in houses with bad hygienic conditions and 38 per cent. were housed in one-roomed tene-

ments. Besides new houses, more than half of the houses visited last year were revisited this year, in which 31 contact children and 17 adults were investigated. Like last year the tuberculosis mortality rate in children below 15 years was found to be 50 per cent. higher than the general mortality rate and the adult mortality rate three and a half times higher in these homes. This line of enquiry is drawing our attention to the clinical types of fatal tuberculosis (meningitis, miliary, osteo-articular, etc.) in infants and children, about which very little is known in this country.

III.—*Incidence of infection among hill tribes.*

It is well known that pulmonary tuberculosis very often runs an acute course among the indigenous population in the border regions of India, particularly among hill people. An investigation was undertaken to ascertain the degree of tuberculisation of the people of Kalimpong and its neighbourhood in the Eastern Himalayas.

A total of 1,650 persons was examined clinically and with Mantoux test, of which 1,151 were males and 498 females. Ninety-one per cent. of them were children. As regards race, 1,163 or the bulk of them were *Nepalis*, 185 *Lepchas*, 135 *Bhutias*, 33 *Chinese* and 134 others. Nine hundred and fifty-four were of " rural " and 694 of " semi-rural " domicile. A history of previous contact with tuberculosis cases was available in only 7 per cent. of cases.

Incidence of positive tuberculin reaction.—Two dilutions were used in the test, namely, 1/1,000 and 1/100. Thirty-six per cent. gave a positive reaction with 1/1,000 dilution. Thirteen per cent. of the negatives proved to be positive in the second test with 1/100 dilution. Thus the incidence of total positives was 44·5 per cent. The incidence among children below 15 years was 38·6 per cent. and among adults 55·3 per cent. 44·7 per cent. of males and 38·9 per cent. of females gave positive reactions. Rural people showed an incidence of 34·9 per cent. and semi-rural 47·4 per cent. *Bustee* areas showed a lower infection rate that the town proper and far-off bazar areas. The Chinese showed the highest incidence, namely 54·6 per cent. Forty-two per cent. of the total reactors gave intense (three *plus* reaction, those belonging to the adolescent age-group showing a comparatively stronger reaction. Contact cases showed 75·6 per cent. and non-contacts 37·5 per cent. positives, the former showing more intense reactions than the latter. Three sources of infection were detected in institutions showing a high percentage of reactors. Sixty-three per cent. showed enlargement of glands of the cervical group, 17·4 per cent. axillary group, 23·6 per cent. inguinal group and 23·4 per cent. submaxillary group. 24·3 per cent. of them showed enlarged thyroid.

It is interesting to note that a survey carried out under this enquiry in 1928 in the plains of Bengal, Bihar, Assam and Madras among 6,500 individuals showed almost the same incidence (45·9 per cent.) as we find in a rural and semi-rural hill area to-day. It appears that infection is spreading fairly quickly in these probably-at-one time " virgin " areas.

About 100 children giving intense tuberculin reaction have been placed under observation. It is proposed to examine them clinically every 6 months and, if possible, also by radioscopy.

IV.—*Typing of Tubercle Bacilli from pathological materials.*

Out of 94 strains which remained untyped last year, 31 have been typed out. Of these 16 were obtained from pleural fluid, 10 from cervical gland pus, 3 from cold abscess pus, 1 from stomach washings and 1 from skin. All of them were found to be of " Human " type.

V.—*Report of the Tuberculosis Survey Committee.*

The 14th Conference of Research Workers under the I. R. F. A. appointed a Committee, consisting of Col. J. A. S. Phillips, C.I.E., I.M.S., Dr. C. Frimodt-Moller, Dr. R. B. Lal, and Dr. A. C. Ukil (convenor) to draw up some standard plans for conducting tuberculosis surveys in various parts of India with a view to evaluate the causal factors of dissemination of tuberculosis and to ascertain how far methods of control employed in Europe with success were applicable to India. A report was submitted to the 15th Research Workers' Conference in December 1937. It is hoped that the officers of the provincial Governments will find it helpful in planning surveys in their respective areas.

VI.—*Post-graduate teaching and editorial work.*

This department participated in organising the King George Thanksgiving Fund post-graduate course in Tuberculosis and in training D. P. H. students in Tuberculosis. Considerable time was taken up with the editing of the special Tuberculosis Number of the Indian Medical Gazette published in April, 1937. Besides these, the department had to answer a considerable number of enquiries from the Central and Provincial administrative and public health authorities.

Staff and organisation.—The officer in charge of this Inquiry has been a voluntary worker since its inception 10 years ago. The staff has been greatly strengthened this year by the employment of Dr. P. K. Sen, M.B., M.D., PH.D., T.D.D., who is conducting the industrial tuberculosis Inquiry. The post of the Histologist has been abolished but Dr. S. R. Guha Thakurta, B.SC., M.B., Medical Assistant, and Mr. A. G. Sinha, Laboratory Assistant, continue to render valuable assistance.

I take this opportunity of expressing my grateful thanks to Dr. R. B. Lal, Officiating Director of this Institute, for affording me accommodation and facilities for work at the Institute. I also desire to express my thanks to the authorities of the Calcutta Medical College and Hospitals and the Tuberculosis Association of Bengal for help in various directions.

Papers published during the year:

(1) Tuberculosis in infants and children. *I. M. G., April 1937.*

(2) The applicability of Phrenic Evulsion in Pulmonary Tuberculosis at the Out-patients' Department of a City Hospital. *Ibid.*

(3) Oleothorax in the treatment of pleuro-Pulmonary Tuberculosis. *Ibid.*

(4) The action of sunlight as a factor in controlling tuberculous infection in guineapigs. *Amer. Rev. of Tuberc. (under publication).*

(5) Some points in the diagnosis of Pulmonary Tuberculosis (adult type). *Trans. Cal. Med. Coll. Re-union, 9th Session, Vol. I, No. 1, Nov. 1937.*

POST-GRADUATE COURSE IN TUBERCULOSIS.

(Dr. B. K. Sikand, M.B., B.S., D.P.H.)

One of the important duties of the King George's Thanksgiving (Anti-tuberculosis) Fund is the training of medical practitioners in modern methods of diagnosis, treatment and prevention of tuberculosis. With this end in view and by permission of the Director-General, Indian Medical Service, and with the full support and co-operation of Dr. A. C. Ukil, Officer-in-Charge, Tuberculosis Inquiry, I. R. F. A., and Senior Visiting Physician, Department of Chest Diseases, Medical College Hospitals, Calcutta, and of other tuberculosis workers, a special training course in tuberculosis was organised by the Fund at the All-India Institute of Hygiene and Public Health, Calcutta, from 4th to 29th January 1937. Facilities offered by other institutions in Calcutta, *viz.*, the Tuberculosis Association of Bengal, Medical College Hospitals and the Jadavpur Tuberculosis Hospital, were freely utilised for the course.

Twenty-eight candidates were selected for the course, due regard having been paid to their past experience in tuberculosis and future facilities for tuberculosis work. The selection was as far as possible distributed equitably over different provinces.

The Central Committee of the Fund defrayed the railway fares of all the selected candidates who attended the course.

All the candidates made the best use of the opportunities offered and showed earnestness in the improvement of their knowledge.

The session started at the Institute on the 4th January with a welcome by the Organising Secretary of the Fund followed by an opening address on the Tuberculosis Problem in India by Sir Nilratan Sircar. Lectures and demonstrations were given in bacteriology, pathology, epidemiology, laboratory and clinical diagnosis, radiological methods and interpretation of radiological findings, medical and surgical treatment, tuberculosis survey, and organisation of anti-tuberculosis work including the role of tuberculosis dispensaries, hospitals, sanitoria, village settlements, etc.

I take this opportunity of expressing our gratitude to all those who co-operated in making the course a success and particularly to Dr. R. B. Lal, Dr. A. C. Ukil, Dr. K. S. Ray, and Dr. Mrs. C. O. Remfry.

Besides Dr. Ukil who took the leading part in giving instructions, the following gentlemen participated in teaching:—Dr. A. R. Mehta, Dr. K. V. Krishnan, Dr. P. K. Sen, Dr. N. Mukerjee, Lt.-Col. E. H. Vere-Hodge, I.M.S., Dr. S. G. Galstaun, Lt.-Col. F. J. Anderson, I.M.S., Dr. R. B. Lal, Dr. Mrs. C. O. Remfry, Dr. J. N. Mitra, Dr. S. Mazumdar, Dr. P. Chatterjee, Dr. C. Frimodt-moller, and Dr. K. N. De.

Annual report of the Maternity and Child Welfare Centre for 1937.

By

M. I. Neal-Edwards, M.D., W.M.S.,

Professor of Maternity and Child Welfare.

~~Medical Report of the Welfare Centre~~.

Introduction.

This is the fifth annual report of the Welfare Centre which was started by Dr. Jean Orkney, W.M.S., in 1933 in connection with the Maternity and Child Welfare Section of the All-India Institute of Hygiene and Public Health.

The object in starting the work was threefold: firstly, to provide a Centre for teaching and demonstration in connection with the courses arranged for students of the Institute of Hygiene, secondly, to make possible the collection of data for research on subjects relating to the health, morbidity and mortality of women and children in Calcutta and thirdly, to carry on intensive welfare work amongst the women and children in the particular area chosen.

The organisation of work has been based on the principle that the activities of the Welfare Centre should be mainly educational and the emphasis throughout has been laid on constructive health teaching. The community amongst whom the work is carried on are in the main, intelligent and able to put into practice the advice given. The area in which the work is carried on is limited to a half of Ward 8 so that the figures for succeeding years represent increasingly intensive work. The co-operation of the public health authorities in supplying birth and infant death lists and of those in charge of hospitals to which cases have been referred is gratefully acknowledged.

Maintenance.

The Welfare Centre was maintained until March 31st, 1937, by a grant from the Countess of Dufferin Fund and by local support from the Corporation of Calcutta and the Calcutta Health Week Committee. On April 1st, 1937, when the Government of India took over the maintenance of the Maternity and Child Welfare Section of the All-India Institute of Hygiene and Public Health, the Welfare Centre became an official part of this Section of the Institute.

The balance of funds standing to the credit of the Calcutta Health Week Clinic account was used for the founding of a new clinic which was opened under the name of "Calcutta Health Week" in Ward 7. The balance of other funds standing to the credit of the Welfare Centre and such furniture and equipment as were in use were handed over by the voluntary societies by whom they were contributed to form the nucleus of the Welfare Centre "Donations Fund" for the purpose of supplying such benefits for the women and children attending the Centre as might not be available from Government funds.

We acknowledge gratefully our indebtedness to these voluntary organisations for their help in maintaining the Welfare Centre during the first four years of its existence.

The K. P. Rai Memorial windows were left under the care of the Welfare Centre and a sum of Rs. 133-14-3 still remains to be expended on their upkeep.

Outline of the work.

The work of the Welfare Centre has continued without interruption throughout the year and no important changes were made when the Centre was taken over by the Government of India. The staff were appointed to the posts they had previously held.

The work of the Centre is under the direction of the Professor of Maternity and Child Welfare who is responsible for the carrying on of antenatal, postnatal and infant clinics.

The staff of the Centre at present consists of two health visitors, two midwives, one Nursery School teacher, two ayahs, one sweeper, two chaprasis and one coolie.

Health Visitors' work.

The senior health visitor is in resident charge of the Welfare Centre. Her work and that of the junior health visitor has three main aspects: (*a*) visiting in the homes, (*b*) clinic work and record keeping and (*c*) supervision of midwives' work.

(*a*) Visiting in the homes is the means whereby antenatal cases and infants are brought under the welfare scheme. Entrance to the homes is effected by following up registered births. Antenatal cases are found during the course of visiting or voluntarily come to the antenatal clinic.

Antenatal cases and infants are visited once a month. Children over a year are visited every three months until they reach 5 years of age. Owing to the increase in home visiting the 3 monthly visit will in future have to be 6 monthly for children over 3 years.

The lists of registered births are received twice weekly from the District Health Office and these births are followed up within a few days of report. Other births are found in the course of visiting. These may be either unregistered births or infants born in hospitals and presumably registered in the Ward concerned. Unregistered births are reported to the Health Officer.

(*b*) *Clinic work and record keeping.*—The health visitors assist at the doctor's clinics and give advice to mothers and children who attend the Centre on non-clinic days. They supervise or carry out the treatment of minor disorders and of such conditions as rickets, anæmia, wrong feeding, etc., for which daily attendance is required. Group teaching for some of the mothers in the district is given in Mothercraft classes which are held weekly during most of the year.

The writing of notes on home visits and other record keeping absorbs a considerable amount of the health visitor's time every day.

(c) *Supervision of midwives.*—The Centre midwives send for the health visitor if any difficulty arises in the course of midwifery in the homes and the health visitor decides what further action is necessary. It is a weak point in the scheme that there is no doctor attached to the Centre who can be called upon if the health visitor needs further help. All cases delivered by the Centre midwives have had antenatal care and have been booked with the doctor's approval so that complications will be few, but cannot be entirely excluded. If any serious difficulty occurs the health visitor has to send the patient to hospital or get the relatives to call in a private doctor. In all cases delivered by the Centre midwives the health visitor follows up the work by visits after delivery and before the patient is discharged.

The Midwives' work.—The midwives attached to the Centre deliver normal cases in the homes. These cases must have attended the clinic for antenatal care and be considered suitable for delivery at home. A booking fee of Rs. 10 is charged but is reduced for necessitous cases. A maternity case is visited for at least 10 days after delivery.

In addition the midwives help in the clinics, give some of the treatments and do some antenatal visiting.

The Nursery School Teacher's work is confined to the Nursery School which is held in the Centre between 10 A.M. and 4 P.M. daily except Saturdays and Sundays.

Birth and Death registration in Half Ward 8.

Births.—Birth registration in Ward 8 is still very defective. Unregistered births found in the course of visiting and reported to the Health Officer during the year amounted to 22 per cent. of the total births known to have occurred in the district. Publicity needs to be given to this subject of failing to register births and if prosecution for this offence under the Calcutta Municipal Act of 1923, Section 451 was carried out registration would become considerably more accurate.

Deaths.—Records of *infantile deaths* have been received from the District Health Officer during the year and have helped to complete our records. But these recorded deaths are known, from the result of visiting, to be incomplete.

No information is received regarding maternal deaths in the area. During part of the year 1937, the Maternal mortality Enquiry in Calcutta under the I. R. F. A. was being carried on and brought to light several deaths of women in the district which would otherwise not have come to our notice. The maternal death figures given for the year (Appendix II) are almost certainly incomplete.

Antenatal Care (Appendix II).

This aspect of the work is making good progress. There were 484 women under antenatal care during the year, 72 per cent. of whom attended the Centre. The number of antenatal cases seen during the year compares favourably with the number of births (459) during the same period and suggests that a high proportion of pregnant women in the district come under antenatal care, but owing to the fact that a considerable number leave Calcutta before confinement and others come to Calcutta for confinement, the proportion of infants born in the district whose mothers have had care is still not nearly so high as could be desired. The number of antenatal cases will have to be considerably in excess of the number of births during the same period before the antenatal service can be said to be functioning fully. When this time comes a larger staff will be required.

Complications of Pregnancy.

Few mothers seen antenatally could be described as thoroughly healthy but the departures from normal were largely minor and many of them could be treated by advice regarding diet, fresh air and sun-light. Such advice is more easily given than carried out in North Calcutta but the Welfare Centre can sometimes help by providing milk for needy cases and by encouraging the mothers to make use of its good open compound.

Anæmia.—A more serious disorder of pregnancy is anæmia, mild degrees of which are very common in pregnancy and during lactation. More exact information regarding the types of anæmia which occur will be forthcoming next year as a result of the hæmatological investigations on pregnant women being carried out in connection with I. R. F. A. Enquiry into anæmia in pregnancy.

During the year under review there were 28 cases of marked anæmia amongst the 484 women seen antenatally.

There was no maternal death from anæmia amongst the antenatal cases, but there were 2 deaths in the district of women not seen antenatally which were believed to be due to this cause.

Toxæmias of Pregnancy.—In the course of the year 3 cases were seen of severe albuminuria of pregnancy and 7 mild cases. Details of these are shown in Table I.

There was 1 case of eclampsia and it was of the fulminating variety. This patient, a 3-gravida, was examined at the Centre at 38 weeks and at that time had no œdema, no albuminuria and the blood pressure was 120/75. She remained well until 5 days later when she complained of a headache, and about two hours later developed fits. She was admitted to hospital for treatment, was delivered spontaneously of a living child and made a good recovery. This was one of those cases which in the present state of our knowledge could not have been prevented by antenatal care.

Osteomalacia.—There were 4 cases of osteomalacia seen during the year and all were Marwari women. The symptoms in each case were mild. One woman had a normal delivery. Another left the district and could not be followed up. Two were still pending on December 31st.

Tuberculosis.—There were 16 women diagnosed as cases of tuberculosis. Of these 14 were examined at the clinics; 13 showed signs of the pulmonary and one of the abdominal form of the disease. Two did not attend the Centre but were seen by the health visitors at home and the diagnosis was a probable one based on the symptoms and progress. Some details of these cases are given in Table II.

Tuberculosis and pregnancy presents the most difficult problem that is met with in the course of maternal welfare work in Calcutta. Hospitals and maternity homes will not knowingly admit these cases in the interest of their other patients, and there is no institution where antenatal and intranatal treatment is available. The Welfare Centre does what little it can by supplying milk and cod liver oil and opportunities for fresh air, but the problem needs more radical methods than this.

Syphilis.—The blood was examined for the Wasserman reaction in 41 antenatal cases, 17 of which were found positive. Courses of treatment by injections were given in the Centre to 9 of the positive cases and to several others in which the obstetrical history was suggestive.

Midwifery (Appendix II).

There were 251 deliveries during the year in 484 cases seen antenatally (Table 3). A considerable number of women leave the district before the time of confinement. There were 94 cases delivered by dais and relatives and 157 or 59 per cent. by trained attendants at home or in institutions. If these figures are compared with those of the attendant at delivery at all births in Half Ward 8 (Table 5) it will be seen that the percentage of trained attendants in the latter was only 42 per cent.

The midwives attached to the Welfare Centre attended 75 confinements in the homes under the supervision of the health visitors during the year.

Abnormal deliveries.—There were 15 abnormal cases amongst the 251 deliveries seen antenatally during the year and three mothers died. The abnormal conditions are shown in Table III. One death occurred 2 months after delivery in a case conducted by the Centre midwife. The labour was complicated by postpartum hæmorrhage. Signs of cerebral embolism occurred and the patient was admitted to hospital 15 days after delivery. She developed femoral thrombosis in hospital but appeared to be making a good recovery when she died suddenly 2 months after delivery probably from another embolism. The other

COMPLICATIONS OF PREGNANCY IN 484 ANTENATAL CASES IN 1937.

TABLE I.—*Toxæmias of Pregnancy (12 cases).*

——	Serial No.	Reg. No.	Age.	Community.	Gravidity.	Weeks pregnant.	Oedema.	Albumen.	Blood Pressure.	
									Syst.	Diast.
Albuminuria of Pregnancy.										
Severe cases . . .	1*	37/10	20	Mohammedan, U. P. .	5	30/52	Present	+++	140	90
	2	37/81	38	Hindu, Gujerat . .	4	F. T.	Present	+	152	80
	3	37/268	27	Hindu, Gujerat . .	9	38/52	Present .	+	150	95
Mild cases . . .	1	37/57	22	Mohammedan, Punjab .	3	38/52	Present .	+	125	80
	2	37/134	37	Hindu, Punjab . .	13	F. T.	Present .	+	105	70
	3	37/225	30	Mohammedan, Delhi .	7	F. T.	Absent .	+	120	85
	4	37/241	17	Hindu, Gujerat . .	1	F. T.	Absent .	Trace	130	80
	5	37/253	22	Hindu, Marwar . .	3	F. T.	Absent .	+	130	80
	6	37/303	20	Mohammedan, Delhi .	2	36/52	Present .	+	128	95
	7	37/235	19	Mohammedan, Gujerat .	1	38/52	Absent .	Trace	134	85
Eclampsia . . .	1	37/167	28	Hindu, Gujerat . .	3	F. T.	Absent .	Absent (5 days before fits).	120 (5 days before fits).	75
High blood pressure . .	1	37/181	23	Hindu, Gujerat . .	4	38/52	Absent .	*Nil*	140	90

N. B.—First visit to Clinic. The other cases developed the symptoms during the course of antenatal care.

TABLE II.—*Tuberculosis (16 cases).*

—	Serial No.	Reg. No.	Age.	Community.	Gravidity.	Form of disease.	Result.	
							Mother.	Infant.
Tuberculosis.								
Attended Centre	1	36/213	27	Mohammedan, N.-W. F. P.	6	Pulmonary and Laryngeal.	Died 3/12 after delivery	Died of tuberculosis 3½/12 after delivery.
	2	36/218	23	Mohammedan, Bengal	6	Abdominal tuberculosis.	Normal delivery—improved	Well.
	3	36/276	18	Hindu, Bengal	3	Pulmonary tuberculosis.	Improved after delivery	Well.
	4	36/290	15	Mohammedan, Punjab	1	Pulmonary tuberculosis.	Normal delivery—condition became worse after confinement.	Died aged 4½ months from (?) tuberculosis.
	5	36/332	29	Hindu, Gujerat	7	Pulmonary tuberculosis.	Normal delivery—good condition.	Well.
	6	37/41	25	Hindu, Gujerat	5	Pulmonary tuberculosis.	Normal premature delivery—general condition fair.	Died 3½ months (?) tuberculosis.
	7	37/68	18	Hindu, Gujerat	1	Pulmonary tuberculosis.	Normal delivery—general condition good.	Well.
	8	37/102	22	Mohammedan, Rajputana.	2	Pulmonary tuberculosis.	Premature delivery in hospital	Died after birth.
	9	37/110	18	Mohammedan, Bihar	1	Pulmonary tuberculosis.	Normal delivery	Well.
	10	37/115	13	Mohammedan, Bihar	1	Pulmonary tuberculosis.	Left	....
	11	37/183	36	Hindu, Bengal	9	Pulmonary and Laryngeal.	Normal delivery—improved	Well.
	12	37/212	16	Mohammedan, U. P.	1	Pulmonary tuberculosis.	Left (mother probably died)	....
	13	37/296	20	Hindu, U. P.	2	Pulmonary tuberculosis.	Left district (died a few months later).	Died (?) Cause.
	14	37/322	30	Mohammedan, Bihar	8	Pulmonary tuberculosis.	Normal delivery—condition unchanged.	Well.
Only seen at home	1	36/270	36	Hindu, Marwar	7	(?) Pulmonary tuberculosis.	Normal delivery—improved after delivery.	Well.
	2	37/201	19	Hindu (?)	1	(?) Pulmonary tuberculosis.	Premature delivery—very poor condition.	Well.

TABLE III.—*Abnormal deliveries in 484 antenatal cases in 1937.*

Serial No.	Condition.	No.	Age.	Community.	Gravidity.	Attendant at delivery.	Treatment.	Result.	Remarks.
1	Disproportion . .	37/35	41	Hindu, Marwar.	9	Centre Midwife and H. V. later Dufferin Hospital.	Caes. Sect. (lower segment).	Mother and child well	Anæmia during pregnancy. No disproportion detected antenatally postmaturity. (?)
2*	Disproportion . .	37/210	18	Hindu, Marwar.	1	Private doctor—late Eden Hospital.	Cæsarean Section .	Mother and child well	Seen once antenatally at 34th week.
3	Disproportion (?) . .	37/224	28	Mohammedan	1	Eden Hospital . .	Forceps . . .	Mother and child well	....
4	Breech	37/241	17	Hindu, Gujerat	1	Centre midwife . .	Extraction . .	Mother well—infant still-born.	Vertex diagnosed antenatally. Breech born before arrival of midwife.
5	Breech	37/231	37	Hindu, Gujerat	9	Eden Hospital . .	Extraction . .	Mother well—infant died a few minutes after delivery.	....
6	Placenta Prævia . .	37/189	24	Hindu, Gujerat	4	Centre H. V. and Dufferin Hospital.	?	Mother and child well	No warning hæmorrhages.
7	Post partum hæmorrhage Cerebral embolism (Sepsis ?)	37/45	22	Hindu, Bombay.	5	Centre H. V. Admitted to hospital 15 days after delivery with mild sepsis and cerebral embolism.	Membranes delivered with artery forceps.	Mother died 2 months later in hospital, child alive.	P. P. H. before and after delivery of placenta. Membranes (?) complete. Cause of death (?) embolism.
8	P. P. H. (and retained placenta).	37/65	27	Hindu, Punjab	7	Centre midwife and health visitor.	Placenta expressed : ergot and fluids.	Mother and child well	....
9	P. P. H. . . .	37/78	21	Hindu, Punjab	2	Centre midwife and health visitor.	Fluids . . .	Mother and child well	P. P. H. after delivery of placenta.
10*	P. P. H. . . .	37/140	?	Hindu, Gujerat	11	Ward 7 Centre midwife and Private doctor.	?	Mother and child well .	....
11	Puerperal Sepsis . .	37/81	38	Hindu, Gujerat	4	Centre midwife (admitted to hospital in antenatal period for alb. of pregnancy).	Ergot, douches, iron	Mother and child well .	Alb. of pregnancy early rupture of membranes. Very mild sepsis.
12	P. P. H. and retained placenta Puerperal sepsis.	36/261	30	Mohammedan Bengal.	3	Dai	Dai removed placenta manually : Private doctor treated puerperal sepsis.	Mother and child well .	Anæmic in antenatal period.
13	Retained placenta and sepsis.	36/337	30	Hindu, Bengal	3	Dai	Dai removed placenta manually.	Mother and child well .	Did not attend Centre—was visited at home in antenatal period.
14	Anæmia and Sepsis .	37/131	35	Mohammedan, Bihar.	9	Dai and private doctor .	?	Mother died—child alive—premature.	Did not attend Centre—was visited at home antenatally.
15	Obstetric Shock . .	36/301	17	Hindu, Marwar	1	Dai	?	Mother died 1½ hours after premature delivery.	Did not attend Centre—apparently healthy—cause of death unknown.

* Out-district cases.

two cases of maternal death occurred in women who had not been examined at the Centre but had been visited at home. One death was from obstetric shock and the other from anæmia and sepsis.

Postnatal Care.

Those women who attended the Welfare Centre in the antenatal period were put on postnatal cards when they came to the Centre again after delivery. There were 81 postnatal cases under care during the year. Records are kept of the health and progress of these mothers until the end of the period of lactation, but the Welfare Centre has no facilities for the gynæcological treatment that is sometimes found necessary and such cases have to be referred to hospitals.

The extensions of the present Welfare Centre work for maternal care which seem most needed are special clinic for the treatment of venereal diseases (only anti-syphilitic treatment is carried out at present) and a gynæcological clinic for postnatal cases. The space and staff do not allow of these being carried on in the Centre. The gynæcological cases can be referred to the hospitals in the vicinity, but there is no V. D. clinic for women in Calcutta to which such cases can be sent.

Infant and Child Welfare.

All registered births are followed up by the health visitors within a few days of the notice being received from the Health Office. A difficulty arises with regard to births which take place in hospitals and which are presumably registered there. No notice is received of these and they may be missed unless the mothers have attended antenatally or they are found in the course of visiting. Other unregistered births which are found to have occurred in the district are reported to the Health Officer who takes steps to follow them up.

The total births registered and found during the year was 459 of which 55 infants had died or left the district before the first visit of the health visitors; and in 5 cases the visit was refused. In addition to these births there were 70 infants who came to the district after birth and were put on cards, making a total of 469 infants put on cards during the year.

There were 304 infants on cards at the beginning of 1937, making a total of 773 infants under care during the year. Of these infants 268 or 34 per cent. attended the Centre during the year. Of the 469 infants born in 1937 and put on cards during the year 219 or 46 per cent. attended the Centre during the year.

The observation cots at the Centre have been available for 1 or 2 children at a time. They are occupied only during the day and the mother generally stays with the child and is taught how to manage it. There were 20 children admitted for observation during the year and the length of stay varied from one day to 3 months. The conditions present included 5 cases of mal-nutrition due to weaning difficulties, mainly failure on the part of the mother to teach the child to take solids, and 2 cases of severe anæmia.

In the absence of a Babies' hospital in Calcutta, such cots as these are extremely useful, the difficulty is that children thus admitted take a considerable amount of the time and attention of the Centre staff.

Infantile Mortality.—There was no serious epidemic in 1937, but the incidence of septic infections of various kinds, *e.g.*, conjunctivitis, infected prickly heat and subcutaneous abscesses, was higher than in previous years. The deaths amongst infants included a larger number than usual from pneumonia and for this no explanation can be offered.

There were 52 deaths of infants on cards, a mortality rate of 111 per 1,000 infants put on cards during the same year. The total infantile deaths in Half Ward 8 was as far as could be ascertained 99, an infantile mortality rate of 215 per 1,000 live births. It must however be remembered that deaths are probably more accurately registered than births.

There were 475 toddlers (children from 1-5 years) on cards at the end of 1937. The mortality rate was 33·7 per 1,000.

The Nursery School.—The Nursery school for children between 2 and 5 years of age has been carried on at the Welfare Centre throughout the year. The average daily attendance was 13.

The Nursery school teacher was re-appointed to the post which she had previously held when the Centre was taken over by Government.

A series of intelligence tests were given to the Nursery school children in July 1937.

Nursery School Time-table.

10 to 11 A.M.	Arrival. Bathroom. Free play and exercises in garden.
11 to 12 NOON	Free play-indoors, insets, beads, building blocks, etc.
12 to 12-30 P.M.	Stories—dramatization.
12-30 to 12-45 P.M.	Putting away toys, tidying rooms.
12-45 to 1 P.M.	Ball game outside.
1 to 1-30 P.M.	Milk and fruit. Bathroom, arranging beds.
1-30 to 3-30 P.M.	Sleep.
3-30 to 4 P.M.	Free play in garden. Bathroom.
4 P.M.	Children go home.

A fee of Rs. 1-8 is charged for attendance at the Nursery school but this is reduced in deserving cases.

The garden shelter which is so badly needed to provide more space and better open air conditions for the Nursery school has not yet been erected.

One of the Nursery school children developed enteric fever in June. He was treated in the hospital for Tropical Diseases and made a good recovery. When this occurred the other Nursery school children were inoculated against enteric.

Other Activities.

Mothercraft classes.—Group teaching on health subjects has been given by the health visitors throughout the year except in the hot weather. Thirty-two classes were held and the average attendance was 8.

Welfare Centre Birthday Party.—The fourth anniversary of the opening of the Welfare Centre was celebrated on May 8th when more than two hundred mothers and children came to the Centre for games and competitions and were shown some health films by the kindness of Mr. S. N. Banerjee, Publicity Superintendent, Public Health Department.

Playground.—The compound which adds so much to the attraction and usefulness of the Centre has been made good use of throughout the year by many mothers and children who otherwise would have had to spend the long hours indoors. The play apparatus, especially the swings are very popular. Badminton has been played by some of the mothers when stimulated thereto by members of the staff.

Acknowledgments.

A Welfare Centre depends largely in the co-operation of outside agencies if the work is to be successful. Apart from financial assistance which has been mentioned before, we wish to express our thanks to the Health Officer, District II, for supplying birth and infantile death lists; to the Imperial Serologist for carrying out W. R. tests; to the Corporation of Calcutta for a supply of milk for distribution; and to the superintendents of hospitals to which our cases have been referred.

APPENDIX I.

Vital Statistics.

Vital Statistics—Ward 8, 1935.

(Only half the ward is being covered by the Maternity and Child Welfare Scheme.)

	Male.	Female.	Total.
Population (1931) . . .	39,545	9,453	48,998
Deaths (1935)	632	412	1,044
Births (1935)	259	218	477
Infant deaths (1935) . . .	107	99	206

Persons per acre—

Calcutta	42	Ward 8	171

Sex proportion: No. of females per 1,000 males—

Calcutta	469	Ward 8	289

Crude death rate—1931 and 1935—

	Calcutta.		Ward No. 8.	
	1931.	1935.	1931.	1935.
Males . . .	19·9	23·2	15·4	15·9
Females . . .	34·4	39·7	24·9	43·6

APPENDIX II.

Antenatal Care and Midwifery.

TABLE 1.—*Antenatal Care, 1933—1937.*

	1933.	1934.	1935.	1936.	1937.
Antenatal cases carried forward . .	...	...	22	52	91
New antenatal cases .	...	...	219	321	381
New antenatal cases out of district .	...	...	21	16	12
Total .	45	158	262	389	484
Number attending antenatal clinic .	26=58%	98=62%	132=50%	211=54%	349=72%

TABLE 2.—*Distribution of antenatal cases seen in 1937 by religion and province of origin.*

Distribution by religion—	
Hindu	311
Mohammedan	173
Total .	484
Distribution by province of origin—	
Marwar	117
Gujrat	99
Bengal	75
Punjab	73
Bihar	48
United Provinces	37
Delhi	12
North-West Frontier Province	9
Madras	8
Sind	3
Not known	3
Total .	484

TABLE 3.—*Welfare Centre Antenatal Cases, 1933—1937.*

	1933.	1934.	1935.	1936.	1937.
Delivered . . .	21	92	163	215	251
Not pregnant . .	7	35	47	17	16
Left district . .				62	112
Pending December 31st	17	31	52	91	104
Unknown . . .	...	...	...	4	1
Total .	45	158	262	389	484

TABLE 4.—*Attendant at delivery of Antenatal Cases, 1933—1937.*

	1933.	1934.	1935.	1936.	1937.
Trained—					
Centre midwife	...	25	46	41=19·1%	75=29·9%
Other midwives	4	10	16	21= 9·8%	21= 8·4%
Hospitals and maternity homes	7	23	26	44=20·5%	54=21·5%
Private doctors	...	...	...	4= 1·8%	7= 2·8%
Untrained—					
Dais and relatives	10	34	75	105=48·8%	94=37·4%
Total deliveries	21	92	163	215	251

TABLE 5.—*Antenatal Cases, Rate of the Fœtus.*

Full-term live births	213=84·86%
Premature live births	18= 7·17%
Stillbirths	10= 3·98%
Abortions	10= 3·98%
Total	251

TABLE 6.—*Percentage of total births attended by trained and untrained attendants in Half Ward 8, 1935—1937.*

	1935. Per cent.	1936. Per cent.	1937. Per cent.
Trained	36	35	42
Untrained	64	65	58

TABLE 7.—*Maternal deaths.*

	1933.	1934.	1935.	1936.	1937.
Maternal deaths in antenatal cases	1	0	1	1	3
Other maternal deaths in district (Half Ward 8)	...	4+	2+	12+	6+
Total deaths	1+	4+	3+	13+	9+

Maternal mortality rate—

Centre Antenatal Cases—

Deliveries	251
Maternal deaths	3

Maternal mortality rate in antenatal cases delivered in 1937=11·9 per 1,000.

Half Ward 8—

Total births (registered and found)	459
Recorded maternal deaths	9

Maternal mortality rate in Half Ward 8 in 1937=19·6 per 1,000 live births.

TABLE 8.—*Causes of maternal death in Half Ward 8, 1937.*

Puerperal sepsis	3
Anæmia	2
Toxæmia	1
A. P. H.	1
Shock	1
Embolism	1
Total	9

APPENDIX III.

INFANTS.

TABLE 1.—*Births in Half Ward 8, 1934—1937.*

	1934.	1935.	1936.	1937.
Births registered and referred by Health Officer . . .	190	307	369	358
Other births found by health visitors and referred to Health Officer . . .	84	87	85	101
Total births .	274	394	454	459
Percentage of unregistered births	30	22	19	22

TABLE 2.—*Infants, 1933—1937.*

	1933.	1934.	1935.	1936.	1937.
Total known births (Half Ward 8)	191	274	394	454	459
Infants put on clinic cards in 1937	212	300	399	436	469
Percentage attending centre .	33	44	43	42	47
Infants died (Half Ward 8 total)	20	40	45	85	99
Infants on cards died . .	...	...	...	53	52
Neonatal deaths in Ward 8 (included in infant deaths above)	...	...	...	26	42= 42 percent. of total infantile deaths.

N.B.—All the births referred from the Health Office were visited; 55 infants had died or left the district before being visited and 5 refused the visit of the health visitor; 70 infants came to the district after birth and were put on cards. This explains the discrepancy between the total births and the total infants put on card during the year.

TABLE 3.—*Infantile Mortality Rate.*

	1936.	1937.
Half Ward 8—		
Infantile mortality rate per 1,000 live births	196·4	215·6
Centre infants—		
Infantile mortality rate per 1,000 infants put on cards in the year . . .	121·5	110·8

TABLE 4.—*Causes of infantile death.*

(Infants on cards, 1936-1937.)

	1936.	1937.	Total.	
Prematurity	4	5	9 = 8·6%	
Pneumonia	11	16	27 = 25·7%	
Gastro-Intestinal diseases	7	8	15 = 14·3%	
Septicæmia	3	...	8 = 7·6%	
Umbilical	...	3	...	
Other forms	...	2	...	
Small-pox	16	...	16	
Measles*	1	2	3	= 19·1%
Whooping cough	...	1	1	
Tuberculosis	...	3	3 = 2·8%	
Congenital syphilis	...	2	2 = 1·9%	
Tetanus	1	1	2 = 1·9%	
Convulsions (cause unknown)	1	1	2 = 1·9%	
Rickets*	...	2	2 = 1·9%	
Neglect or starvation	3	2	5 = 4·8%	
Unknown	6	4	10 = 9·5%	
Total	53	52	105	

* Secondary cause unknown.

APPENDIX IV.

Toddlers (aged 1-5 years).

TABLE 1.—*Toddlers.*

	1933.	1934.	1935.	1936.	1937.
Transferred from infant cards	...	...	164	217	239
Total toddlers on cards at end of year	44	129	293	362	475
Toddlers attending clinic	38	61	...	137	202=42·5%
Toddlers who left district	4	34	33	61	101
Toddlers who attained 5 years	...	...	3	10	11
Deaths of toddlers (1-5 years) on cards	2	5	12	20	16
Mortality per 1,000	...	38	40·9	54·6	33·7

TABLE 2.—*Causes of toddlers' death, 1936-1937.*

	1936.	1937.	Total.	
Diarrhœa and Dysentery	3	4	7	=19·4%
Pneumonia	3	2	5	=13·9%
Typhoid	1	2	3	=38·9%
Measles	...	3	3	
Whooping cough	...	1	1	
Small-pox	7	...	7	
Tuberculosis	1	...	1	= 2·8%
Anæmia	...	2	2	=5·6%
Unknown	5	2	7	=19·4%
Total	20	16	36	

APPENDIX V.

Clinic Attendance, 1936-37.

	1936.	1937.
Antenatal cases—		
First visits	211	307
Revisits	1,000	1,228
Total	1,211	1,535

Average weekly attendance of antenatal cases in 1937=29.

	1936.	1937.
Postnatal cases—		
First visits	24	81
Revisits	...	546
Total	24	627

Average weekly attendance of postnatal cases in 1937=12.

	1936.	1937.
Infants—		
First visits	183	219
Revisits	2,154	2,415
Total	2,337	2,634

Average weekly attendance of infants in 1937=51.

	1936.	1937.
Toddlers—		
First visits	97	104
Revisits	2,268	4,050
Total	2,365	4,154

Average weekly attendance of toddlers in 1937=80.

	1936.	1937.
Total clinic attendance in 1936-1937—		
Antenantal cases	1,211	1,535
Postnatal cases	24	627
Infants	2,337	2,634
Toddlers	2,365	4,154
Total	5,937	8,950

Average total weekly attendance in 1937=172.

APPENDIX VI.

Home Visiting.

TABLE 1.—*Health Visitors' home visiting, 1936-1937.*

	1936.	1937.
Antenatal Home visits—		
First visits	290	300
Revisits	535	630
Infants Home visits—		
First visits	456	493
Revisits	2,532	2,337
Toddlers Home visits—		
First visits	205	220
Revisits	1,650	1,628
Postnatal Home visits	107	370
Total	5,775	5,978

Average number of visits per month by each health visitor (excluding one months' holiday in the year)=272.

TABLE 2.—*Midwives' domiciliary work.*

Confinements conducted in the homes (includes 35 cases conducted by the midwife pending her re-appointment)		75
Postnatal visits to confined cases		471
Antenatal first visits	29	
Revisits	144	
Total	173	

APPENDIX VII.

NOTES ON CERTAIN FINDINGS FROM THE WELFARE CENTRE RECORDS, 1936-37.

1. *Obstetrical histories of 414 multiparæ.*—There were 414 multiparæ amongst the 484 antenatal cases seen in 1937. The previous obstetric histories of these women provided the following information:—

Total previous pregnancies	1,615*
Children born alive	1,372
Stillborn	71
Abortions	173
	1,616*

This gives a stillbirth rate of 51·75 per 1,000 live births and an abortion rate of 126·09 per 1,000 live births.

The number of children born alive and still living at the time of report was 877 or 63·92 per cent. of total live births.

The above facts relate to uncompleted families for all the women were again pregnant when the above histories were taken.

2. *Blood Pressure in Pregnancy.*—Little information being yet available regarding normal standards of blood pressure in women in this country an attempt has been made to analyse the records obtained in the course of routine antenatal examination at the Welfare Centre. For this purpose only healthy women have been considered, and those in whom diseases of heart, lungs, kidneys, was found or anæmia or toxæmia of pregnancy was detected have been excluded. When taking blood pressure records the urine has been examined and the presence or absence of albumen checked by the worker taking the blood pressure reading. No case showing albuminuria at any stage of pregnancy has been included. The records have been made by two observers who have used the same instrument, a baumanometer, during a period of two years.

TABLE 1.—*Blood pressure readings in pregnancy.*

Stage of pregnancy in weeks.	—20		20—29		30—35		36—40	
	Syst.	Diast.	Syst.	Diast.	Syst.	Diast.	Syst.	Diast.
11 Multiparæ.								
Mean of 11 cases	106·36	66	111·36	70·45	113·82	70·18	114·82	72
3 Primiparæ.								
Mean of 3 cases	113·33	71·67	113·33	70	116·67	70	116·67	70

* One pair of twins.

TABLE 2.—*Blood pressure in 386 healthy Indian women during pregnancy.*
(Readings were not available in each stage in every case.)

Weeks pregnant	—20		20—29		30—35		36—40	
Multiparæ (329 cases).								
No. of cases	143		129		142		130	
	Syst.	Diast.	Syst.	Diast.	Syst.	Diast.	Syst.	Diast.
Mean	105·45	65·82	105·19	65·31	108·87	67·80	109·45	70·30
Primiparæ (57 cases).								
No. of cases	21		17		29		19	
	Syst.	Diast.	Syst.	Diast.	Syst.	Diast.	Syst.	Diast.
Mean	110·95	67·88	117·06	71·53	112·72	70·45	115·53	73·16

In order to analyse the blood pressure records pregnancy has been arbitrarily divided into four stages: before the 20th week, 20-29th week, 30-36th week, 36-40th week, and the records of blood pressure obtained in these stages have been tabulated and the mean values ascertained

There were 386 healthy women (329 multiparæ and 57 primigravidæ) for whom records in one or more stages were available, but there were very few of these for whom a record was available in all four stages of pregnancy. If the blood pressure had been examined on more than one occasion in any one stage, as generally happened in the latter part of pregnancy, the highest reading was used except when this occurred at the time of the first visit to the clinic and excitement might have played a part.

There were only 11 multiparæ and 8 primigravidæ for whom a record was available in each stage. The mean of the systolic and diastolic pressures in these cases in succeeding stages of pregnency is shown in Table 1.

Table 2 shows the mean of all cases for which records were available in the different stages. The number of cases from which records were taken in each group is shown. Both tables show two similar trends:—

(i) The blood pressure, both systolic and diastolic is somewhat higher in primigravidæ than in multiparæ.

(ii) The systolic and diastolic pressures tend to rise in succeeding stages of pregnancy.

3. *Duration of Normal Labour.*—A record is kept of the duration of labour in cases confined in the homes by the Centre Maternity Service. The average duration of the first and second and of the third stage of labour in 99 normal confinements is shown in the following Table 3. No case in which any abnormality such as premature rupture of membranes or excessive hæmorrhage occurred has been included.

TABLE 3.—*Mean duration of normal labour in 99 Indian women delivered at home by Welfare Centre Midwifery Service.*

	1st and 2nd stage of labour.		3rd stage of labour.	Total duration of labour.	
	Hrs.	Min.	Min.	Hrs.	Min.
Multiparæ.					
Mean of 82 cases	9	1	10	9	11
Primiparæ.					
Mean of 17 cases	13	57	10	14	7

MGIPC—L—III-38—9-11-38—1,000.

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Errata.

Page 3, 8th line from the bottom	Instead of "17th July" please read "13th July".
Page 6, 21st line from the bottom.	Instead of "but which are not fully known at present" please read "but these are not fully known at present".
" 3rd line from the bottom.	Instead of "but also bring" please read "but also brings".
Page 8, 25th line from the bottom.	Instead of "Valuable statistical tables of exact significance" please read "Valuable statistical tables of certain exact tests of significance".
Page 33, 3rd line from the bottom.	Instead of "letter" please read "latter".
Page 34, 19th line from the bottom.	Instead of "muco" please read "muco-".
Page 39, 19th line from the bottom.	Instead of "1,200" please read "12,000".
Page 54, 14th line from the bottom.	Instead of "Bonsdroff's" please read "Bonsdorff's".

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All-India Institute of Hygiene and Public Health, Calcutta.

Staff—1938.

Director.

Dr. R. B. Lal, M.B.B.S., D.P.H., D.T.M. & H., D.B., F.N.I. (Officiating).

Assistant Director.

Captain K. Satyanarayana, M.B.B.S., A.I.R.O.

A.—Staff of the Institute.

Department of Public Health Administration—

Professor—Dr. R. B. Lal, M.B.B.S., D.P.H., D.T.M. & H., D.B., F.N.I. (Officiating).

Assistant Professor—Dr. S. C. Ghosal, M.B., D.P.H. (CAL.), D.B. (LOND.).

Department of Vital Statistics and Epidemiology—

Professor—Dr. R. B. Lal, M.B.B.S., D.P.H., D.T.M. & H., D.B., F.N.I.

Assistant Professor—Mr. Satya Swaroop, M.A. (Officiating).

Mathematical Assistant—*Vacant.*

Department of Biochemistry and Nutrition—

Professor—

Dr. H. Ellis C. Wilson, M.B., ch.B., D.Sc. (up to 28th February 1938).

(The post remained vacant from 1st March 1938 to 30th October 1938.)

Dr. G. Sankaran, M.B.B.S. (from 31st October 1938).

Assistant Professor—

(Vacant from 1st January 1938 to 27th February 1938.)

Dr. G. Sankaran, M.B., B.S. (Officiating from 28th February 1938 to 30th October 1938).

(Vacant from 31st October 1938 to 21st December 1938.)

Dr. Bashir Ahmad, M.Sc., Ph.D. (resumed duties from 22nd December 1938).

Department of Malariology and Rural Hygiene—

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Assistant Professor—Dr. Banamali Ghosh, M.B., D.P.H.

Assistant Research Worker—Dr. Phanindra Nath Bose, M.B., D.P.H., D.T.M.

Department of Maternity and Child Welfare—

Professor—

Dr. M. I. Neal-Edwards, M.D., W.M.S. (up to 19th February 1938).

Dr. S. Pandit, M.B.B.S., D.M.C.W. (acting from 20th February 1938 to 31st March 1938).

(Vacant from 1st to 3rd April 1938.)

Dr. Jean M. Orkney, W.M.S. (on deputation from 4th April 1938 to 30th June 1938).

(Vacant from 1st July 1938 to the end of the year.)

Assistant Professor—Dr. B. Muktha Bai, M.B., B.S., D.M.C.W. (appointed from 6th June 1938).

Department of Sanitary Engineering—

Professor P. A. Midha, M.Sc., M.Eng., M.I.Struct.E. (appointed from 17th March 1938).

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Department of Protozoology—

Professor—Dr. B. M. Das Gupta, L.M.P. (Dacca).

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Assistant Professor of Public Health Laboratory Practice in Bacteriology—Dr. R. K. Banerjee, M.B., D.P.H., D.T.M. (CAL.).

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Assistant Professor of Pathology—Dr. Kalipada Banerjee, M.B., D.T.M. (CAL.).

Department of Entomology—

Professor—

Dr. C. Strickland, M.A., M.D. (CANTAB.), B.Chir. (up to 14th July 1938 and from 28th September to 31st December 1938).

Dr. D. N. Roy, M.D., D.T.M (CAL.), (Officiating from 15th July to 27th September 1938).

Assistant Professor—Dr. D. N. Roy, M.D., D.T.M. (CAL.).

Department of Serology and Immunology—

Professor—Lt.-Col. S. D. S. Greval, B.Sc. (PUNJAB), M.D., Ch.B., D.P.H. (LIV.), I.M.S.

Assistant Professor—Captain S. N. Chandra, M.B. (CAL.).

Department of Chemistry and Physics—

Professor—Dr. Sudhamoy Ghosh, D.Sc., M.Sc., F.I.C.

Assistant Professor—Mr. Nihar Ranjan Chatterjee, M.Sc. (CAL.).

C.—Special Research Staff under the Indian Research Fund Association.

1. Cholera Carrier and Epidemiological Enquiries—

Officer-in-charge—Dr. R. B. Lal, M.B.B.S., D.P.H., D.T.M. & H., D.B., F.N.I.

Mathematical Assistant—Mr. K. C. Basak, B.A. (CANTAB.).

Bacteriologist—Dr. S. C. Seal, M.B.

2. Epidemic Dropsy Inquiry—

Officer-in-charge—Dr. R. B. Lal, M.B., B.S., D.P.H., D.T.M. & H., D.B., F.N.I.

Field Medical Officer—Dr. S. C. Roy, M.B., D.P.H.

Assistant Field Medical Officer—Dr. A. C. Das Gupta.

Chemist—Mr. S. P. Mukherjee, M.Sc. (from 1st April 1938).

3. Tuberculosis Inquiry—

Officer-in-charge—Dr. A. C. Ukil, M.B. (CAL.), M.S.P.E. (PARIS), F.S.M.F. (H.C.), F.N.I.

Research Assistant—Dr. S. R. Guha-Thakurta, B.Sc., M.B.

Industrial Tuberculosis Research Worker—Dr. P. K. Sen, M.B., M.D. (BERLIN), Ph.D., T.D.D. (WALES).

Assistant Surgeon—Dr. Monimohan Bose, M.B. (from 17th July 1938).

4. Blackwater Fever Inquiry—

Officer-in-charge—Dr. K. V. Krishnan, M.B.B.S., D.B., M.R.C.P., D.Sc., F.N.I.

Organic and Physical Chemist—

Mr. N. Gopala Pai, M.A. (up to 27th October 1938).

Dr. M. Narsimha Rao, M.B.B.S. (from 1st November 1938).

5. Anæmia and Eclampsia Inquiry—

Officer-in-charge—

Dr. M. I. Neal-Edwards, M.D., W.M.S. (up to 19th February 1938).

Dr. L. E. Napier, M.R.C.P. (from March 1938).

Lady Doctors—

Dr. S. Pandit, M.B.B.S., D.M.C.W. (up to 19th February 1938).

Dr. Jyotsna Dei, M.B.B.S. (from 21st February 1938).

Dr. Sita Dharamvir, M.B.B.S. (up to 30th April 1938).

Dr. G. Aggarwal, M.B.B.S. (from 11th May 1938).

Pathologist—

Dr. D. N. Mukherjee, M.B. (up to 27th September 1938).

Dr. S. S. Mukherjee, M.B. (from 28th September).

ANNUAL REPORT OF THE ALL-INDIA INSTITUTE OF HYGIENE AND PUBLIC HEALTH FOR THE YEAR 1938.

During the year under report, a number of changes took place in the superior staff. Dr. Wilson, Professor of Biochemistry and Nutrition, left the Institute on the 28th February to take up a position in his home university. The post remained vacant for 8 months after which period it was taken by Dr. G. Sankaran. Dr. Bashir Ahmad, the Assistant Professor who had been away on a Rockefeller Fellowship, resumed his duties at the end of the year. His post also remained vacant for 4 months having been occupied by Dr. Sankaran for the rest of the period. In the Department of Maternity and Child Welfare, Professor's post was occupied temporarily for a month and a half by Dr. S. Pandit who relieved Dr. M. I. Neal-Edwards at the end of February. The post remained vacant for the rest of the year, except for a period of nearly 3 months when it was temporarily filled by Dr. Jean Orkney. Dr. B. Muktha Bai, the newly appointed Assistant Professor joined in June. Mr. P. A. Midha was appointed as Professor of Sanitary Engineering in the middle of March. Within a fortnight, he proceeded on a study tour to Turkey, Greece and Jugoslavia, and resumed his duties after the vacation. The post of Mathematical Assistant in the Department of Vital Statistics and Epidemiology remained vacant throughout the year and Mr. S. Swaroop, the permanent incumbent continued to officiate as Assistant Professor. On Dr. Neal-Edwards' transfer from the Institute, Dr. L. E. Napier took charge of the Pregnancy Anæmia and Toxæmia Enquiry.

Teaching.—In last year's report, a reference was made to the manner in which our *ex*-students had been employed. The position was again reviewed this year. Information was available for 96 out of a total of 108 students who had so far qualified from the Institute. Of these, only 37 were occupying public health posts—19 in rural areas, 14 in urban and 4 in combined rural and urban areas. Medical appointments were held by 14 *ex*-students—6 each in rural and urban areas, and 2 in the railways. Research work engaged 4 graduates as in the previous year, but one fresh graduate obtained a laboratory appointment making a total of 5 employed in this type of work. The position has considerably improved with regard to the employment provided by the local authorities, there being an addition of 10 graduates absorbed by them. State service was procured by 6 more graduates. However, the number of those who are engaged in private practice after obtaining their public health qualifications is still on the increase, and it has now reached a total of 33. It will thus be seen that although it is fully recognised that the country is badly in need of a vigorous and forward policy in regard to public health organisation, even the small number of technically trained personnel is unable to find employment in this national endeavour.

This paradoxical situation arises from the fact that keen though they are to advance health and efficiency of the people, the authorities find it difficult to launch extensive schemes for health protection, because they are confronted with the magnitude of the problem on the one hand

and with the paucity of funds on the other. They find that most of the available funds are already appropriated by the curative medicine which as an organisation is not only well-established by tradition, but yields immediate demonstrable results. Any proposal for curtailment in this activity of the State necessarily meets with strong and organised protest. The results of preventive medicine are difficult to demonstrate, and in fact no convincing proof of actual rise in communal health has so far been produced in the country, nor could it be expected to appear with the present rudimentary public health organisation and with the inadequate technical methods for assessment.

The urge for public health organisations has mainly come from calamities such as heavy toll of life taken by plague and the achievements of foreign countries in this direction, and consequently the health schemes have either been designed as temporary arrangements to meet a threatening catastrophe or have been copied from other countries particularly England with or without modification, specially because this had been successfully done in the case of curative medicine. However, the growing recognition of the fact that preventive medicine unlike the curative medicine for which standardised organisations have been evolved, must necessarily vary from country to country according to the local, sociological, climatological and other circumstances, and also on account of the financial limitations placed on such activities, the provincial medical and public health departments have in recent years been trying out various ways to meet the Indian requirements, *viz.*, the provision of curative and preventive medicine at a very small cost, not only for the benefit of the sick town dwellers, but also for the poor wretch living in the remotest hamlets.

This is no easy task and it is not surprising, therefore, that no agreed scheme has so far been devised. Whatever schemes may ultimately command the greatest degree of agreement, one thing is certain and that is that the demand for trained personnel will greatly increase. In the meantime, the authorities of the Institute have to cast the course of training which will best suit future requirements but which are not fully known at present. The best that can be done under the circumstances is to proceed on general principles. In previous years' reports, the point has been emphasised that facilities for field training which are as essential for the public health students, as are hospitals for medical students, are inadequate at the present time. It has also been pointed out that provision of these facilities is specially important in this country where our graduates are expected to take independent charge of big urban or rural communities without a period of assistantship which, in other countries, gives them opportunities for practical training. However, now that the prospects of facilities for such training are particularly bright, one has to consider what proportion of practical training or apprenticeship should bear to the pedagogic instructions. The latter type of training equips the students with the scientific principles on which health activities are to be organised. Its chief merit is that it enables him to adapt his organisation to the local circumstances. Field training, on the other hand, not only exemplifies the application of those principles and thus strengthens grasp over them, but also bring the student face to face with the realities of life with the attendant difficulties and methods of solution. This supplementary instruction cannot be provided by intra-mural teaching, however, good

and extensive it may be. On the other hand, without pedagogic instruction, the field training is likely to degenerate into unintelligent, unprogressive fossilised practices. In an army organisation, where the will of the supreme command prevails over that of the disciplined soldier and to a large extent over the caprices of Nature also, set rules of instructions can be successfully followed no matter where the regiment is located. In towns, too, standardised conditions of life more or less prevail and many but not all problems of public health are alike even in cities widely separated from one another. In rural areas on the other hand, where Nature's supremacy over man's will is still great, the conditions of life differ widely from place to place. Under these circumstances, the health schemes which have efficiently worked in one area may require to be thoroughly modified when applied to another locality. Here a grinding in scientific principles on which health programmes are based, requires considerable emphasis. In any scheme of re-organisation of the training programme of the Institute, it is, therefore, desirable to keep these requirements of the country in mind, so that, the pedagogic instruction is harmoniously supplemented by field training.

Course held.—The number of applications received this year was 57; of these 47 possessed medical degrees or equivalent qualifications, and 10 were licentiates. Twenty-six students were admitted to the D. P. H. course and 4 to the D. P. H. & Hy. course of the Faculty of Tropical Medicine, Bengal.

The constitution of the class was as follows:—Indian Medical Service —*nil*, Indian Medical Department—1, Provincial Medical Service—*nil*, Indian States Service—4, Provincial Public Health Service—1, Public Health Service under Local Bodies—11, Railway Service—2, other agencies (including mercantile firms, shipping Co., tea plantations, jute mills, mines, industries, etc.)—*nil*, and private practitioners —11, total 30.

The distribution according to provinces was as follows:—Assam—1, Bengal—12, Orissa—*nil*, Hyderabad—2, Central Provinces—1, Bombay —1, Bihar—4, United Provinces—2, Punjab—3, North-West Frontier Province—*nil*, Burma—*nil*, Madras—2, Cochin State—1, and Travancore State—1, total 30.

Special Post-Graduate Course.—One student was admitted to the special course in Malariology in October session.

D. Sc. Course.—One student was admitted to the course, his subject being Epidemiology.

D. M. C. W. Course.—One student joined the course.

Examination results.

D. P. H., Part I.—Twenty-five students appeared and 20 passed in the May Examination; 6 appeared (5 regular students and one irregular student) and all passed in the September Examination.

D. P. H., Part II.—Five appeared in May and all passed while 26 appeared and 21 passed in September.

(One irregular student took a *composite course* from July 1st for appearing in the D. P. H. September Examination for Parts I and II of the Calcutta University. He failed only in Part II.)

D. P. H. & Hy., Part I.—Four appeared and 2 passed in May Examination, and 2 re-appeared and passed in September Examination.

D. P. H. & Hy., Part II.—None appeared in May Examination. Four appeared and 3 passed in September Examination.

D. M. C. W., Part I.—One appeared and passed in January Examination.

D. M. C. W., Part II.—One appeared and passed in August Examination.

Research and investigations.

Cholera. The report of the Professor of Vital Statistics and Epidemiology deals with further statistical and field epidemiological investigations on cholera. The endemic status of the homogeneous districts in South-Western Bengal has been redefined, after giving due weight to the size of their population and area. Although most of the endemic areas are situated along the lower reaches of the Hooghly, no general relationship between the great river and water systems of the province and the cholera behaviour of the various areas could be established. It was found that the non-endemic areas, did not, as a rule, exhibit a high degree of epidemicity. One may be justified in contemplating the future optimistically, because it has been found that cholera incidence shows a downward trend in all the areas under investigation, particularly so in certain homogeneous districts.

The new methods of forecasting cholera epidemics, referred to in the previous reports, was successfully applied to the Calcutta experience for the third year in succession. It was also found that the method was applicable to the majority of the homogeneous cholera districts.

Valuable statistical tables of exact significance have been prepared and published. These, it is hoped, shall be widely used by research workers in different fields.

Recent researches in the epidemiology of cholera have centered round one primary problem namely the determination of the distinctive laboratory test for the causative organisms of cholera. It has been held that the solution of other fundamental problems in the epidemicity and endemicity of cholera are dependent upon an answer to this problem. It has been claimed that there is a unanimity of opinion regarding the "agglutinable vibrio" (sub-group I of Gardner and Venkataraman) providing a solution of the primary problems. The observations made in the field suggest that even in certain non-endemic areas in Bengal, infection of water and of human subjects with the "agglutinable vibrio" is quite common. The infection is perhaps transitory and for some unknown reason the clinical manifestations of the disease do not occur except at relatively long intervals. There appears to have been established an equilibrium between the man and the organism which for some reason is occasionally upset. This observation is perhaps of considerable practical importance, because of the possibility of the occurrence of cholera epidemics due to the upsetting of this equilibrium as a result of well-meaning, though ignorant interference with the course of Nature by human agencies.

Epidemic Dropsy.—In last year's report, a hope was expressed that methods other than human experiments may be discovered to distinguish between samples of toxic and non-toxic mustard oil. This

hope has been realised. With the help of simple tests which are described in the report of the Professor of Vital Statistics and Epidemiology, the health authorities can now detect the toxic oil and suppress its use for culinary purposes and thus prevent the occurrence of the disease. It has also been shown that the poisonous substance in the oil is derived from seeds of *Argemone mexicana* which resembles dark brown variety of mustard seeds. *Argemone mexicana* grows wild in all parts of the country and probably the contamination of the mustard seeds takes place principally at the time of harvesting. By removing this weed from fields where mustard is cultivated, the disease can be efficiently controlled. The nature of the poisonous substance is still under investigation. A white crystalline organic substance which gives the differential test has been isolated; whether or not it is the toxic substance still remains to be determined.

Salmonella Enquiry.—Fever and diarrhœa of unknown origin is widely prevalent in Indian town. The possibility of the origin of some of these cases in bacterial food poisoning was investigated. Preliminary investigations have shown that a high percentage of rats, caught at random, in Calcutta, carry salmonella organisms. Further investigations are in progress, but the facts so far revealed should serve to stimulate public interest in the destruction of this pest even in the absence of plague.

Blackwater Fever Inquiry.—Dr. Krishnan records 5 more cases of successful treatment of Blackwater fever. So far no failures with his treatment have been reported.

He pursued his enquiry on hypo-vitaminosis in the malarial subjects to which reference was made in last year's report. He was able to show that the distribution of normal, border line and sub-normal children in respect of vitamin C deficiency is strikingly different in healthy and malarial subjects. A chronic state of hypo-vitaminosis is established in chronic malarial cases. This important observation would partially explain the mechanism of fatal spleen rupture occurring spontaneously or as a result of slight trauma in old malaria cases. It should also be of assistance in rationalising the treatment of malaria cachexia. Some suggestive evidence in favour of the use of vitamin C in conjunction with quinine has been obtained in the case of malaria.

Studies in the bionomics of *A. philippinensis*—the most important carrier species in Bengal—reveal the fact that unlike *A. culicifacies*, it prefers water having a high Co_2 ratio. It was also noticed that tanks with profuse *Euglena* or *macrocystis* were not suitable breeding grounds for this species. One of these factors might possibly be exploited for controlling *A. philippinensis*. It was also comfortable to note that paddy fields did not permit of breeding *A. philippinensis*.

Kala-azar.—Attention having been directed to the fact that man resists infection given experimentally to the bite of carrier insects or even injection of massive doses of L. donovani, explanation for natural infection has been sought in biochemical changes resulting from dietetic errors and endocrine disturbances and malaria and typhoid infections. For this purpose some animal experiments have been carried out and encouraging results have been obtained.

Biochemistry and Nutrition.—During the year under report, diet surveys were undertaken in Dinajpur District, Bengal and Jorehat,

Assam, representing peasant and industrial populations respectively. A special investigation on Marwari families was also carried out; details will be found in Dr. Sankaran's report, but the important fact brought out is that the diet of the peasants and to a lesser degree that of the industrial workers is deficient to the extent that it gives rise to clinical manifestations of nutritional diseases in a good proportion of the population. This finding deserves special attention on the part of health and agricultural authorities. Generally speaking, the nutritional condition of the children was far from satisfactory as judged by the A. C. H. index. The diet of the Marwaries, as may be expected, was found deficient in animal proteins. For the people of this community who are strict vegetarians, the only recommendation that could be made is a more extensive use of milk, curds, and sweets containing milk products.

Dr. Sankaran's report also refers to certain interesting surveys of specific dietetic factors. With a locally made modified Birch-Hirchfeld visual photometer, he was able to show demonstrable vitamin A deficiency in as many as 43 per cent. of lower class prisoners and in 17 per cent. of those on better diet. His results further show that vitamin A deficiency would be largely missed, in the lower group particularly, if the ordinary clinical signs such as dryness of the conjunctiva and Bitot spot were taken as criteria. They also show that in most cases, the deficiency could be removed within a week by the administration of vitamin A concentrate in suitable doses.

Striking results regarding the calcium metabolism on various types of rats have been obtained by Dr. Mullick with a special technique of micro-incinerated sections of teeth. An important suggestion has been made that this technique could be utilized to give precise information of the children's calcium-phosphorus metabolism through examination of the deciduous teeth. The report also makes references to the enquiries for the determination of hæmoglobin and of the diameter of red blood corpuscles by special techniques which reduce labour without sacrificing accuracy.

Dr. Sankaran has made use of spectro-photographic equipment in a number of biochemical investigations. A broad absorption band with a maximum at 2750 A. U. was demonstrated in certain samples of mustard oil which has been experimentally shown to give rise to symptoms of epidemic dropsy or which had been suspected as being causally associated with the disease on epidemiological grounds. Similar bands could also be demonstrated in 5 to 10 per cent. mixture of *Argemone mexicana* oil in pure mustard oil. This equipment has also been employed in detecting the sulph-hæmoglobin anæmia in patients receiving sulphanilmide preparations. No barium, however, could be detected in blood samples of patients put on barium meal for X'ray examination.

Tuberculosis Inquiry.—Dr. Ukil's report deals with tuberculosis problem in connection with jute industry which is Bengal's premier industry. His investigations are of special importance at the present time when both the problems of organised industry and of tuberculosis are in the public eye on account of the keen interest of the public in tuberculosis due to the inauguration of the King George's Thanks-giving (Anti-tuberculosis) Fund by Her Excellency the Marchioness of

Linlithgow. The labour in India differs from that in highly industrialised countries like Great Britain in one important respect, namely, that it is migratory and keeps continuous touch with home. This circumstances creates two special problems, namely, (1) a constant source of infection is transmitted from the urban industrial centres to the unimmunised community in the rural homes, and (2) the infected persons disappear from the scene of industrial activity with the resultant loss of control over them and the difficulty in estimating correctly the health hazard due to industry and slum conditions of living. Jute industry is a dusty industry but the damage it is likely to do depends largely upon the size of the particles and their chemical nature. We possess little or no information on these matters and it is Dr. Ukil's endeavour to elucidate these and many other points in connection with the influence of this industry and of urban environment on the tuberculosis problem in the industrial area and in the village homes. The results so far obtained are enough to bring out the importance of the problem to Bengal and many other parts of India from which the jute mill labour is drawn. It is to be hoped that the enquiry will in time lay bare the vital points on which an effective and fruitful attack on tuberculosis can be directed. Difficult as the tuberculosis problem in India is, it should be relatively easy to achieve some results amongst the industrial labour after Dr. Ukil has supplied the basic information.

Stipends.—One student who was taking D. M. C. W. course was kindly granted a stipend of Rs. 50 per month by the Indian Red Cross Society.

Museum.—Further additions of exhibits were made to the museum this year, particularly in sections relating to nutrition, maternity and child welfare, tuberculosis, venereal diseases, port health administration and vital statistics. Since the importance of health education is being increasingly recognised, various groups have been attracted to the museum for instruction. Thus students were received from Sir John Anderson Health School and from the various medical colleges and schools in Bengal, as also the students taking Tuberculosis Health Visitors' course. Requests were also received from heads of certain institutions for instructions on preparing material for museums. A large number of requisitions were received for permission to copy the exhibits which were gladly complied with. The growing usefulness of the museum is necessitating greater attention and technical assistance.

Library.—During the year under review, 196 books, 178 reports, and 156 bound volume of journals were added to the library. This brings the total stock of the library at the end of 1938 to 5,961. Of the books, 118 were purchased and 78 were free gifts; 52 reports were received on payment and the rest were obtained mostly in exchange for the Institute report; 86 volume of journals were subscribed while 70 were received free of cost.

General observations.—During the year, the Institute was visited by the Director General, Indian Medical Service, Public Health Commissioner with the Government of India, Drs. Sawyer and Strode of the Rockefeller Foundation, and Mr. Yeatts, I.C.S., Joint Secretary to the Government of India, Department of Education, Health and Lands.

The Public Health Society continued to hold monthly meetings in which public health workers including the staff and the students of

the Institute met and discussed the various subjects related to public health. These meetings provided welcome facilities to the students to come in personal contact with the workers in public health and gave them a wider outlook on public health matters.

The meetings of the Biochemical Society to which the students were admitted served useful purpose.

The staff of the Institute took prominent part as in previous years in organising a one month's course in Tuberculosis under the King George's Thanks-giving (Anti-tuberculosis) Fund.

The monthly meetings of the senior staff and the joint meetings of the research workers of the School of Tropical Medicine, and of the Institute were held as usual.

The Institute Restaurant worked satisfactorily. It was fully made use of by the members of the staff and the students. Thanks are due to Mr. Satya Swaroop, the Honorary Secretary, for his efficient management.

It is a great pleasure to acknowledge the help and co-operation from my colleagues and co-workers in this Institute on whom additional duties and responsibilities were imposed by shortage of superior staff. I also gratefully acknowledge with thanks the ready help and co-operation which I received throughout the year from Bt.-Col. R. N. Chopra, C.I.E., K.H.P., Sc.D., I.M.S. (Retd.), and other members of the staff of the School of Tropical Medicine. The Institute continued to receive financial assistance generously provided by the Indian Research Fund Association for a number of enquiries.

REPORT OF THE PROFESSOR OF VITAL STATISTICS AND EPIDEMIOLOGY.

(Dr. R. B. Lal, M.B., B.S., D.P.H., D.T.M. & H., D.B., F.N.I.)

The activities of the department fall into two main divisions, *viz.*, teaching and research.

Teaching.—The usual course consisting of lectures, demonstrations and practical classes in vital statistics and general and special epidemiology was given to students preparing for D. P. H. Examination of the Calcutta University and D. P. H. & Hy. and D. M. C. W. courses of the Faculty of Tropical Medicine and Hygiene, Bengal.

Dr. A. Rahaman of the Bihar Public Health Department successfully completed a three months' special course in advanced statistics and epidemiology. During the course of his work he undertook an investigation into the typhoid epidemic which had broken out in one of the largest residential hotels of the city.

Dr. S. Raghavendra Rao of His Exalted Highness Nizam's Public Health Service joined the department in October 1938 as a D. Sc., student to continue his researches in the epidemiology of plague with special reference to Calcutta. During the year 1935-36 he had carried out an intensive rat-flea survey of Calcutta city. This survey had revealed, contrary to the prevailing belief, that *X cheopis* predominates in some of the wards where other conditions are also not unfavourable for the spread of plague. Why is it that plague does not spread in spite of these conditions is a problem which is being investigated further by Dr. Rao. In this connection he has collected various statistical data regarding the incidence of plague and certain climatic factors. A large number of *G. varius* (the most prevalent species of rat in Calcutta) were collected and sent to Haffkine Institute, Bombay. The results indicated that these rats were highly susceptible to plague. Further studies on this aspect of the problem are in progress.

The laboratory has been equipped with a series of charts and diagrams designed in the department for purpose of teaching the more advanced statistical methods and to bring out points of importance of the Indian vital statistical data.

Research.

Cholera Carrier and Epidemiological Inquiry, Statistical section.—The advantage of studying the epidemiology of cholera in Bengal on the basis of homogeneous cholera districts has been mentioned in previous reports, in which varying characteristics of the homogeneous cholera districts in regard to some epidemiological features have been mentioned.

This year the main problem of endemicity and epidemicity of the homogeneous districts was taken up and suitable methods were devised for classifying the homogeneous districts into endemic and non-endemic areas with varying degrees of epidemicity. When proper allowance is made for the size of population and the number of *thanas* composing the homogeneous districts out of the nineteen districts nine are found to be endemic and the rest non-endemic. Further, the endemic regions

are mostly situated along the lower reaches of the River Hooghly. The epidemicity of both the endemic and non-endemic areas has been determined on the basis of the contribution of the yearly variability to the total variation in each case. Non-endemic areas as a rule do not exhibit any high degree of epidemicity, whereas two of the endemic areas show fairly high probability of epidemic visitations.

The trends of cholera mortality in the homogeneous districts were studied and it was found that cholera mortality was declining significantly in the case of ten homogeneous districts.

The distribution of the homogeneous districts was studied with reference to the distribution of the important rivers and water system of the province, but no direct relationship could be established between the two distributions. A further study of the epidemiology of cholera and its relationship with certain specific factors like physiographical features, climate, movement and density of population, was made on the basis of the information available in the District Gazetteers of Bengal. This study, however, fails to establish any direct influence of these factors on the epidemiological characteristics of the cholera districts.

The new method of forecasting cholera, mentioned in previous reports, gave fairly good prediction for Calcutta in 1938, this being the third year of successful forecast since 1936. The method was applied to the homogeneous districts and on preliminary investigation it has been found out that the method may prove efficient in the case of about ten districts. Further work is in progress.

Rogers' hypothesis of a critical level of absolute humidity as a determining factor in cholera forecasts was tested in respect of data from widely separated towns like Calcutta, Gorakhpur, Saharanpur, Sialkote and Lahore; it was found that this hypothesis was untenable.

Field section.—A field enquiry was conducted with two objects in view:—(1) To test the efficiency of a modified Wilson and Blair's differential medium for the isolation of agglutinable (Inaba 0 positive) vibrios from natural sources, and to study, with the help of this technique, the distribution of agglutinable vibrios in endemic and non-endemic areas. Preliminary investigations were conducted by Major W. D. B. Read, I.M.S., in Calcutta and the work was later extended to rural areas. Comparative results of vibrio isolation from samples of stools of cases and of healthy persons, and from water samples collected in Calcutta, and in two groups of villages are shown in tables I to V. It will be seen from table V that the differential medium is comparatively superior in picking up the agglutinable vibrios than the peptone medium which is usually employed. It has also another advantage over the latter medium, namely that it suppresses the growth of fæcal organisms.

(2) The medium, though superior to peptone water cannot be considered wholly efficient in isolating the agglutinable vibrios, because it failed to isolate these organisms from a large number of samples of stools of cholera patients (*vide* table II). This conclusion is, however, subject to two important provisos, namely, that all the cases enumerated were true cholera cases and that the stools of all the true cholera cases contained visible agglutinable vibrios. From the analysis of the clinical records of these cases, it appeared that the isolation of the agglutinable vibrios was more frequent in typical than in atypical cases, but there

were quite a number of failures in clinically typical cases, and that some atypical cases also yielded positive results.

1: Agglutinable vibrios were isolated from a tank in Rampurhat in the absence of cholera in the village or the neighbourhood for a period of four months. They were also isolated from a tank in Patliachandra which had been free from the disease for nearly 7 years, although some cases were reported in the neighbouring villages shortly afterwards. Water from the infected tank at Rampurhat had been used for drinking purposes without giving rise to an outbreak of the disease.

2. Although Nischintapur had been free from cholera for over two years and Patliachandra for nearly seven years as mentioned above, 71 per cent. (27 out of 38) of the population in the former and 68 per cent. (34 out of 50) in the latter village showed evidence of specific immunity against the agglutinable vibrios as demonstrated by agglutination test.

With the possible exception of the period of persistence of infection, these results are in accord with our finding in Diamond Harbour as reported in previous years. They seem to suggest that widespread invisible infection with the agglutinable vibrios transitory though it may be, is present amongst the population in the water sources even in the non-endemic areas in Bengal. Even if it be assumed that the agglutinable vibrios is the sole causative organism, it would appear that in the partially immunised population, at any rate, this organism by itself does not give rise to epidemics of cholera through drinking water, in the quantities in which it may persist in the tanks. What other factors, whether relating to quantity or quality of infection or to herd immunity and facilities for transmission, come into play in initiating epidemics in these areas still remains to be elucidated.

Studies on population.—In last year's report, it was mentioned that a critical study of the demographical data collected in the course of cholera investigation at Diamond Harbour was taken up. This study was completed during the year. It provides, for a population of over 10,000 persons detailed information regarding their distribution with respect to age, sex, occupation, caste, marital status, economic status, diet, health, sanitary conditions, water supply and density of population. The information relates to typical rural area and was collected by house to house survey for a period of three years by trained workers who were resident in the locality. A paper setting out the plan of the investigation and the comparisons of these distributions with similar data for Bengal has been published.

Recent population studies have revealed that an investigation into the differential fertility of the different types of population will offer the most important solution to the problem of future trends of population growth in India. With this purpose in view an inquiry is being planned to assemble and analyse data bearing on fertility of Indian women which has been collected in various antenatal clinics, hospitals, and maternity welfare centres in Calcutta.

Significance test tables.—Construction of a series of tables for facilitating laboratory workers in carrying out exact significance tests was completed. These tables provide three-fold information:—

(i) Values of probability that in a controlled experiment for testing the relative effects of two treatments a response combination of results will occur due to pure chance.

(ii) Size of samples sufficient to get a known percentage difference in treatment responses as significantly different.

(iii) Values of log $n!$ to five places of decimal for integral values of n up to 10,000.

Miscellaneous.—The department continued to assist and carry out tabulation and analysis of data collected by outside workers. Punching of Dr. Rice's cards relating to 10,000 cases of cholera in Assam was continued. The data regarding clinical and pathological aspects of tuberculosis cases, collected from various dispensaries under the auspices of the Tuberculosis Association of Bengal was put on Powers-Samas cards. The analysis of data collected over the last two years is proceeding.

TABLE I.

Isolation of vibrios from sources in Calcutta using W. & B.'s medium.

Sources.	Specimens.								
	Isolations.			Serology.				Mannose.	
Nature.	Number of cases.	Number of specimens.	Vibrio positive numbers.	Percentage.	Inaba O+.	Inaba H+.	Nag.	Fermented.	Not fermented
Stools from cholera cases	37	45*	13	28·9†	13	0	0	13	0
Stools from healthy individuals and non-cholera patients	186	186	39	21	0	0	39	29	10
Water samples from tanks, rivers, etc. . . .	78	174	136	78	4	..	132	125	11

* All these samples were vibrio-negative on first examination using peptone water.
† No record of Inaba O negative or Nag vibrios was kept.

TABLE II.

Isolation of vibrios from sources in Calcutta using 1 per cent. peptone water.

Sources.	Specimens.									
	Isolations.				Serology.			Mannose.		
Nature.	Number of cases.	Number of specimens.	Vibrio positive numbers.	Percentage.	Inaba O+.	Inaba H+.	Nag.	Fermented.	Not fermented.	Not tested.
Stools from cholera cases . . .	35	76	25	32·9	8 (10·5%)	0	17	12	7	6
Stools from non-cholera patients . .	106	106	8	7·5	0	0	8	2	6	0
Water samples from tanks, rivers, etc. .	12	14	14	100	0	0	14	10	4	0

The results of field investigations are shown in tables III and IV.

TABLE III.

Isolation of vibrios from sources in Rampurhat and Basirhat Centres using W. & B.'s medium.

Sources.		Specimens.								
		Isolations.			Serology.				Mannose.	
Centres.	Nature.	Number of cases.	Number of specimens.	Vibrio Isolation No.	Percentage.	Inaba O+.	Inaba H+.	Nag.	Fermented.	Not fermented.
Rampurhat . .	Stools from healthy individuals.	66	66	4	6	0	0	4	4	0
Basirhat—										
Group A . .	Stools from healthy individuals	121	121	5	4	0	0	5	5	0
Group B . .	Stools from cholera convalescents.	3	18	10	55	7	2	1	10	0
	Stools from cholera contacts .	21	74	17	23	4	1	12	14	3
	Stools from healthy contacts .	2	2	0	0	0	0	0	0	0
Rampurhat . .	Water samples from tanks, rivers, wells, etc.	36	41	2	5	1	1	0	2	0
Basirhat—										
Group A . .	Ditto .	38	40	20	40·8	2	5	13	16	4
Group B . .	Ditto .	8	26	22	78·5	1	8	18	14	8

TABLE IV.

Isolation of vibrios from sources in Rampurhat and Bashirhat Centres using peptone water.

Sources.		Specimens.								
		Isolations.			Serology.				Mannose.	
Centres.	Nature.	Number of cases.	Number of specimens.	Vibrio positive No.	Percentage.	Inaba O+.	Inaba H+.	Nag.	Fermented.	Not fermented.
Bashirhat—										
Group A . .	Stools from cholera convalescents.	3	18	8	44	5	2	1	8	0
	Stools from cholera contacts .	21	74	14	19	4	0	10	12	2
	Stools from healthy non-contacts.	2	2	0	0	0	0	0	0	0
Groups A & B .	Water samples from tanks .	7	23	23	100	0	4	19	16	7

TABLE V.

Comparative results of isolations from the same samples using W. & B.'s medium and peptone water.

Serological character.	Stools (245 samples).					Waters (23 samples).				
	Vibrios isolated with both media.	Vibrios isolated with W & B alone.	Vibrios isolated with peptone water alone.	Positive with W & B but negative with peptone.	Vibrios isolated with peptone but negative with W & B.	Vibrios isolated with both media.	Vibrios isolated with W & B alone.	Vibrios isolated with peptone alone.	Vibrios isolated with W & B but negative with peptone.	Vibrios isolated with peptone but negative with W & B.
Inaba O positive	24	24	17	9	5	1	1	0	1	0
Inaba O negative	25	24	21	8	5	22	14	23	0	8
Total .	49	48	38	17	10	23	15	23	1	8

TABLE VI.

Agglutination reaction against Inaba O (titre 25 or higher), of samples of blood taken from healthy non-contacts in three villages.

Village centre.	Number of samples examined.	Number showing positive reactions.	Inoculated group.			Uninoculated group.		Persons drinking water from positive tanks.		Uninoculated and not drinking from positive tanks.	
			Last date of inoculation.	Number examined.	Number showing positive reactions.	Number examined.	Number showing positive reactions.	Number examined.	Number showing positive reactions.	Number examined.	Number showing positive reactions.
Patliachandra (Bashirhat centre).	50	34 (68%)	November 1931.	12	8 (66%)	38	26 (68·4%)	32	21 (65·6%)	13	10 (77%)
Nischantapur (Rampurhat centre).	38	27 (71%)	April 1936.	27	18 (66%)	11	9 (81·8%)	20	18 (90%)	4	3 (75%)
Kamra (Rampurhat centre).	40	4 (10%)	*Nil*	*Nil*	*Nil*	40	4 (10%)	*Nil*	*Nil*	*Nil*	*Nil*

TABLE VII.

Persistence of vibrios in stools of cases and contacts and in water samples.

Village centre.	Sources.	Date and result.	Date and result.	Date and result.	Date and result.	Date and result.	Date and result.	Date and result.	Date and result.
Dakshin-Gulaichandi (Bashirhat)	Contact	7-9-38	12-9-38	21-10-38					
		0+	*Nil.*	*Nil.*					
Ditto	Do.	7-9-38	14-9-38	18-10-38					
		0+	Nag.	*Nil.*					
Ditto	Do.	7-9-38	12-9-38	16-9-38	19-9-38	20-10-38	25-10-38		
		0+	*Nil.*	*Nil.*	*Nil.*	*Nil.*	*Nil.*		
Ditto	Case	7-9-38	12-9-38	21-10-38	26-10-38				
		0+	Nag.	*Nil.*	*Nil.*				
Kodalia (Bashirhat)	Do.	7-9-38	12-9-38	16-9-38	19-9-38	18-10-38	20-10-38	21-10-38	27-10-38
		0+	0+	0+	0+	H+Nag	*Nil.*	*Nil.*	*Nil.*
Ditto	Do	9-9-38	12-9-38	16-9-38	19-9-38	21-10-38	27-10-38		
		0+	*Nil.*	0+	H+	*Nil.*	*Nil.*		
Ditto	Contact	9-9-38	14-9-38	21-10-38	21-10-38				
		0+	*Nil.*	*Nil.*	*Nil.*				
Nischantapur (Rampurhat)	Water	19-7-38	24-7-38	26-7-38	28-7-38	13-11-38	16-11-38		
		0+	*Nil.*	*Nil.*	H+0±	*Nil.*	*Nil.*		
Patalichandra (Bashirhat)	Do.	26-8-38	31-8-38	2-9-38	5-9-38	7-9-38	14-9-38	21-10-38	31-10-38
		0+	0+Nag.	Nag.	H+Nag.	Nag.	Nag.	H+Nag.	H±
Kodalia (Bashirhat)	Do.	9-9-38	12-9-38	14-9-38	16-9-38	19-9-38	18-10-38	21-10-38	
		Nag.	0+	Nag.	H+	H+	Nag.	Nag.	

Epidemic Dropsy Inquiry.

Field investigations.—These were carried out in seven different centres in Bengal, namely (1) Rangpur, (2) Alamdanga, District Nadia, (3) an Institution in Calcutta, (4) a portion of the Sundarbans area, (5) Manirampur near Barrackpore, (6) Suri, District Birbhum and (7) Sahora, District Murshidabad.

The primary object of these investigations was to collect epidemiologically incriminated samples of mustard oil for detailed chemical and other examinations. The investigations at Sundarbans and at Sahora were undertaken much too late to be of use. From the remaining five places, " suspected " samples of oil were collected, those from Rangpur and Alamdanga being available in bulk. With the oil from these two latter places, human feeding experiments were carried out to test their toxicity. Two out of three volunteers put on Rangpur oil showed definite symptoms of the disease, with the Alamdanga oil, only one suspicious case developed in a group of 3 volunteers. However, all the six volunteers on the test oils developed some premonitary symptoms, *e.g.*, diarrhœa, fever, etc. The 3 controls on the jail-produced oil remained healthy throughout. As soon as the object of the experiment was served, the administration of the oils was stopped. A section of skin from the leg of one of the experimental cases was examined histologically. The pathological changes observed were similar in nature, but not advanced to anything like the same degree as seen in skin sections obtained from *post mortem* of cases of epidemic dropsy.

Through the courtesy of the Director of Public Health, Bengal, and by our own field staff about 300 samples of mustard oil from different places, where outbreaks of epidemic dropsy had been reported, were collected together with their epidemiological histories entered in a standard form. On the basis of the information received, each sample was classified according to its degree of association with the disease. With the proved toxic oil from Rangpur and with the samples so collected physical, chemical and histological tests were undertaken with a view to (i) developing a differential test between the toxic and non-toxic oils and (ii) finding out the nature and origin of the deleterious substance in the poisonous oil.

Development of differential tests:—

(a) *Biological.*—These tests may be described under two headings, *viz.*:—

(1) Feeding experiments on animals.

(2) Intracutaneous injections in human subjects.

The experiments on animals are still in progress and will be reported later on. The technique employed for the skin test was as follows:—

A small patch of skin on the dorsum of either arm was gently scarified with a rotary vaccinator without drawing any blood. On the right side a pad of lint soaked in heated test oil was placed, and on the other was placed a similar pad soaked in heated jail produced oil. The pads were kept in position continuously (except at the time of bathing) by means of vaccination shields and elastic bands. The pads of oil were renewed every 24 hours and the scarification was performed twice every week. The experiment was continued for a month. Observations

made with a hand lens failed to demonstrate any local reaction in any of the subjects.

(b) *Chemical.*—(1) The usual physical and chemical constants required under the Bengal Food Adulteration Act of 1919 were determined. The proved toxic oil showed no evidence of adulteration.

(2) A large number of reagents were employed to test for possible adulterants of mustard oil. It was found that the toxic oil possessed a greater reducing property than the non-toxic oil. With regard to other tests, the results were negative except with Crace Calvert's and Cavalli's reactions for non-drying oils. With these two reagents, an orange red colour developed in the bottom layer when mixed with the toxic oils, but this did not occur with a known non-toxic oil. It was noted that nitric acid was a common factor in both these reagents.

(3) Hauchecorn's test, which consists in vigorous shaking of a little oil with an equal volume of concentrated nitric acid was next performed. A brownish red colour developed in the bottom acid layer with the proved toxic oil, whereas this acid layer remained quite clear with a known non-toxic oil, thus suggesting a differential test between the toxic and the non-toxic oils.

(4) Another test, which was tried at the suggestion of Dr. S. S. Bhatnagar of Lahore, and found differential was the addition of a small quantity of a 3 per cent. solution of cupric acetate to an equal quantity of test oil acidified strongly with glacial acetic acid. On heating, a precipitate was formed and the colour of the watery layer changed from blue to green in case of the toxic oil, but did not do so with a non-toxic oil. Since cupric acetate test was believed to be a specific reaction for mercaptan and other sulphur compounds, ethyl mercaptan and allylisothiocyanate were added to jail-produced oil but these treatments did not render it positive to the nitric acid or spectrophotometric tests.

(5) The chemical tests were performed on about 300 samples of mustard oil with varying epidemiological histories. There was a close relationship between the distributions of samples according to their epidemiological histories and the results of the chemical tests, showing thereby that the tests were differential.

(c) *Physical tests.*—(i) *Spectrophotometry.*—Side by side with the chemical tests, spectrophotometric studies by the absorption method, were made on samples of oil in alcoholic solution. These studies showed that the nature of the curve was alike in all instances, but the sample of proved toxic oils showed a broad absorption band between 2,900 λ and 2,600 λ with a maxima near about 2,750 λ.

(ii) When the toxic oil was exposed to ultra-violet radiation, it exhibited a characteristic bluish violet fluorescence. The intensity of fluorescence was greater in the Rangpur oil than in the Alamdanga oil. It was absent in the jail-produced oil. This test, however, proved too sensitive for practical application.

The differentiating physical and chemical tests, especially the chemical ones, place in the hands of the public health authorities, an important weapon for fighting the disease, for, it is a simple matter to test the oil and prevent the sale and consumption of supplies which prove positive to these tests.

Source of the poisonous substance in the oil.—For an effective control of the disease it is essential to find out the source from which the poisonous substance in certain supplies of mustard oil is derived. There were, as mentioned on a previous occasion, two possibilities, *viz.*:—

(i) the deterioration of mustard seeds themselves on account of faulty storage and infection with some fungoid or other form of organisms,

(ii) (*a*) adulteration of the oil with some cheap poisonous oil,

(*b*) admixture of the mustard seeds with some poisonous seeds either deliberately or inadvertantly.

All these possibilities have been investigated. The results may be summarised below:—

I.—*Deteriorated mustard seeds.*

A good supply of mustard seeds which had apparently been damaged by fungoid growth was obtained. Oil was expressed from these seeds and was tested by means of feeding experiments on human volunteers. The general outline of the experiment was the same as reported previously. No ill effects were observed in any of the experimental subject.

II.—*Use of adulterants.*

(a) *Adulteration with some other oil.*—This has been discussed above.

(b) *Adulteration of mustard seeds with other seeds.*—The observation that millowners themselves very often suffered from the disease suggested the possibility that the source from which the oil derived its poisonous substance was unknown to them. The possibility, therefore, of the seeds themselves being inadvertantly mixed with some poisonous seeds resembling mustard seeds was investigated.

Taking the lead from two published reports as also after examining a number of samples of mustard seeds from different oil mills of Calcutta, the seeds of *Argemone mexicana* were suspected to be the source of the poisonous substance in the mustard oil. The oil expressed from these seeds was examined and it was found that a mixture of about 6 per cent. of this oil with jail-produced mustard oil satisfied the same physical and chemical tests as the known toxic oil from Rangpur.

These observations are consistent with the hypothesis that the poisonous substance in the oil, causing the symptoms of epidemic dropsy is derived from the seeds of *Argemone mexicana* which grow wild and plentiful in various parts of India, and get mixed with the mustard seeds in varying proportions at the time of harvesting or possibly they are deliberately adulterated with mustard seeds before these latter seeds reach the millowners.

Nature of toxic substance.—With a view to isolating the toxic substance, Rangpur oil and oil of *Argemone mexicana* were split into saponifiable and non-saponifiable fractions in the usual way. A white crystalline substance soluble in hot alcohol and in dilute hydrochloric acid was obtained. It gave intense reactions on applying the differential tests. The crystals were obtained in fairly large amounts from *Argemone* oil, but in smaller quantities from Rangpur oil, while none could be

recovered from jail-produced oil. Further work on this crystalline substance is in progress.

Incidence of Salmonella group of organisms in rats.—Our knowledge on the bacterial food poisoning in India is very scanty. Recent works in England and America are increasingly incriminating rats as important reservoirs of Salmonella infection. An enquiry was, therefore, initiated during the year to find out the relationship between these organisms and rats in Calcutta. Over 250 rats were collected from different parts of the town and liver, spleen, and fæces of each were examined for the presence of Salmonella organisms. Over 14 per cent. were found to be infected with organisms which agglutinated with H and O sera of either *Bact. artrycke* or *Bact. enteritides*. The findings are of considerable interest, considering the close relationship between human being and rats in this country. Detailed antigenic analysis had to be held up as all the necessary specific sera were not available. These have now been secured and the work is being carried out to establish definite identity of the organisms.

Types of C. diptheriæ prevalent in Calcutta.—This work is being continued from previous year. A further series of over 150 throat swabs of diphtheria patients was examined and 105 strains of the organisms were isolated. The results corroborate our previous findings that Gravis and Intermediate types are very rare in Calcutta. Some difference in colonial appearance was noticed in the Mitis types which seem to be more virulent than that observed in England. Further work is in progress and the results will be embodied in a paper in near future.

Staff.—The department worked with a depleted staff during the year. The post of the mathematical assistant remained vacant throughout.

Papers published.

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8. Lal, R. B., Ahmad, B., and Roy, S. C. — Allylisothiocyanate as an ætiological factor in Epidemic Dropsy, Ind. Jour. Med. Res., Vol. 26, July 1938.
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REPORT OF THE PROFESSOR OF MALARIOLOGY AND RURAL HYGIENE.

(Dr. K. V. Krishnan, M.B.B.S., M.R.C.P., D.B., D.SC.)

Staff.—There was no change in the personnel of the Department.

Teaching.—The D. P. H. and D. P. H. & Hy. students were given as usual special courses of lectures on malariology, tuberculosis, and venereal diseases. In addition, lectures on the other communicable diseases of importance to India were also given. The post-graduate students specialising in tuberculosis under the King George Thanksgiving (Anti-Tuberculosis) Fund were given a series of lectures on the bacteriology of tuberculosis. As the need for a comprehensive book on communicable diseases from the Indian stand point is being increasingly felt, a book is being written and it is hoped that it will be published in 1939.

During this year Dr. K. Roy, the Health Officer of Ranchi municipality, took the special course in malariology and Dr. A. W. J. Morgan, District Medical Officer, E. B. Railway, took a special course in communicable diseases.

Help to outside Agencies.—Infected anopheline mosquitoes and suspensions of sporozoites in normal saline were supplied to the Professor of Clinical Medicine, Medical College, Calcutta, for treatment of cases of neurosyphilis and G. P. I.

In connection with the proposed construction of a European residential School in Dum Dum, a survey was conducted of the site and the extent of malarial danger to the residents discussed with the authorities.

During the malaria epidemic this year special facilities were provided at the field malaria centre under our control for the distribution of quinine to the sufferers. The necessary drug was very kindly provided by the Bengal Public Health Department.

Research.

Treatment of Blackwater Fever Cases.—During this year five more human cases of blackwater fever were treated, thus bringing the total to eleven cases. The utility of the combination of cortin, ascorbic acid and glucose, recommended by us from the results of biochemical and pathological studies of blood and tissues of monkeys developing hæmoglobinuria and of man developing blackwater fever, was confirmed. The uniform success so far attained is encouraging indeed.

Vitamin C and Malaria.—With the advent of Tillman's method of estimation of vitamin C in the blood and of Harris and Ray's saturation test for vitamin C in the urine, the changes in vitamin C metabolism in health and disease have been frequently investigated. Although from these investigations it was clear that vitamin C got generally depleted from the body during pyrexial attacks, there was no literature available regarding the degree of depletion of this vitamin in malaria. During this year an investigation was therefore conducted

to find out the vitamin C excretion and saturation in normal and malarial subjects resident in a hyperendemic malarial village in Bengal.

Children between the ages of two and ten were alone examined. Twenty-four hourly excretion of ascorbic acid in the urine was determined by the well-known technique of titrating it with a standard solution of dichlorophenolindophenol. After ascertaining the rate for three consecutive days, a test dose of ascorbic acid (equivalent to 50 m.gms. of ascorbic acid per stone of body weight) was administered and the variation in the rate of excretion of the acid during the ensuing 24 hours ascertained. According to the results obtained the children were classified as " normal ", " borderline " or " sub-normal ".

Judging by the amount of ascorbic acid the child excreted during twenty-four hours in urine and taking an excretion of 13 m.gms. and over as " normal ", 10 to 13 m.gms. as " borderline " and less than 10 m.gms. as " sub-normal ", the following results were obtained:—

TABLE I.

	Healthy children.	Malarial subjects.
	Per cent.	Per cent.
Normal	80	27·3
Borderline	15	9·1
Sub-normal	5	63·3

If on the other hand the vitamin C deficiency was judged by the saturation test and an excretion of 50 per cent. or more of the test dose within 24 hours was taken as normal, 25 to 50 per cent. as borderline and less than 25 per cent. as sub-normal, the results were found to be as follows:—

TABLE II.

	Healthy persons.	Malarial cases.
	Per cent.	Per cent.
Normal	10	6·1
Borderline	55	6·1
Sub-normal	35	87·8

From these two tables and from a detailed study of the variations in individual cases, during the different stages of the malarial paroxysm, the following conclusions were drawn:—

(1) That the majority (65 to 95 per cent.) of healthy children between the ages of two and ten show normal vitamin C saturation.

(2) That the majority (60 to 87 per cent.) of malarial patients show a condition of hypovitaminosis C.

(3) That during an acute attack of malaria there is an increased excretion of ascorbic acid in the urine and during the afebrile interval the excretion is markedly less.

(4) That in chronic malarial subjects there is a well marked subscurvy state which is made more and more intense by every subsequent attack of fever.

(5) That the degree of hypovitaminosis C is most intense in malarial subjects belonging to a low economic status.

Rotter's Test.—An attempt was made to confirm the above findings by using the Rotter's intradermal test. The test gave inconsistent results and it was given up as unreliable.

Vitamin C and relapse in Malaria.—A laboratory investigation to find out the effect on the relapse rate in monkey malaria (*P. knowlesii*) of supplementing quinine treatment with vitamin C was conducted. In all eleven monkeys were experimented upon and these belonged to two groups—Vitamin C group and Quinine group. Monkeys of both groups were infected with *P. knowlesii* and as soon as the parasite count rose to 1 per cent., quinine treatment was started which was supplemented in one group with vitamin C. The first group of animals got per day 0·75 gr. of quinine hydrochloride intramuscularly. and 100 mgms. of ascorbic acid intravenously, and the second group only quinine. Treatment was continued till the peripheral blood was negative for parasites. The animals were then kept under laboratory conditions and the relapse rate noted. Although it is premature to give any definite conclusions there appeared to be no difference between the two groups.

Phosphatase activity in Malaria.—Our previous biochemical studies on the blood of monkeys infected with *P. knowlesii* and on human beings developing hæmoglobinuria showed that there was a marked upset in the phosphorus metabolism. It was observed that the organic and inorganic phosphorus contents of the blood rose high during the prehæmoglobinuric stage. The rise in organic phosphorus was explained as being due to the increased production of fatty acids, but a satisfactory explanation for the increase in inorganic phosphorus could not be found; although the hydrolysis of hexose-phosphate by the tissues and the rapidly multiplying parasites appeared to be a feasible explanation. It was therefore considered necessary to study the exact mechanism by which the inorganic phosphorus content of the blood was raised and to gauge the extent to which a damaged liver contributed towards this. With this object in view a study of the phosphatase activity was undertaken. The animals used consisted of both splenectomised and non-splenectomised ones, infected and uninfected. Although the work is as yet incomplete, it was noticed that as the infection progressed, there was a tendency for the phosphatase activity of the serum to increase.

Periodical appearance of Malaria epidemics.—In last year's report the results of our preliminary investigation of the causes for the periodic appearance of epidemic malaria in the field malaria centre situated in the Burdwan District were presented. There it was stated that the exacerbation of malaria every 5 or 6 years was attributable to the unusual rainfall that generally occurred during the dry months of February and March and the consequent increased production of carrier anopheles. This question was further studied this year and the view already expressed was further corroborated. A careful analysis of the records collected during the last three years was compared with other available records for the previous years. The three years studied include a non-epidemic year and two years which were involved in the epidemic. Dividing each year into three periods (1) the malarial

season, from July to October, (2) the cold weather, from November to February and (3) the hot dry months from March to June, the picture was as follows:—

In the non-epidemic year the parasite rate is 25 to 30 per cent. in the malarial season, 10 to 15 per cent. in the cold weather and 5 to 10 per cent. in the dry season. In the first year with unusual rainfall in the dry months no increase of malaria was noted in the dry season, despite the fact that there was a marked increase in the anopheline population and the temperature and humidity factors were also favourable for transmission. This was, however, accounted for by the low percentage of gametocyte carriers. In the malarial season that followed, however, not only did the anophelines become more numerous but also the number of new cases. The parasite rate rose to 40 to 45 per cent. and this high rate continued into the cold weather. Unusual rainfall again fell in the dry months and a real epidemic of large magnitude broke out. Malaria prevailed unabated throughout the year and the parasite rate went up to 70 per cent. in the malarial season. These observations confirm the view that the excessive rainfall in the dry months leads to the progressive increase in the carrier anophelines, and this in turn leads to an increase in the number of new cases. It appears to be possible to predict an epidemic on the basis of the rainfall occurring in the dry months.

A new factor for forecasting epidemic Malaria.—In connection with the forecasting of epidemic malaria it was stated above that the extent of rainfall in the dry months is an important factor. Parasitological studies conducted throughout the year for a period of 3 years have given another clue for prediction. All the three species of malarial parasites occur in the area studied. A study of their relative incidence gave the following results: In the non-epidemic year the predominating species practically during all the months of the year was Quartan. More than 50 per cent. of the cases in February, March, April and May and in July, August and September were due to this parasite and the other 50 per cent. to the other two species. In the epidemic year on the other hand the predominating species was Falciparum. More than 50 per cent. of the cases in every month of the year was due to this species and the other 50 per cent. to Quartan and *Benign tertian*. The latter parasite remained more or less at a constant level in both the epidemic and non-epidemic year. It would thus appear, that some unknown factors determine the predominance of quartan over falciparum and these in turn determine whether the year is going to be an epidemic or non-epidemic year. Whenever quartan gets the upper hand malaria appears to go down and epidemics do not appear; but when quartan goes down and falciparum gets the upper hand epidemics arise. From a study of the relative incidence of the two species specially in the earlier months of the year (the dry season) it appears to be possible to forecast an epidemic rise in the ensuing malaria season. This is true of the area studied by us; but whether the same will hold good for other malarious areas in West Bengal or not, it is difficult to say

Breeding of A. philippinensis.—In the malaria centre under our control although there are 159 tanks it is only in about 3 to 35 per cent. of them that *A. philippinensis*, the carrier species is found to

breed. This provided an opportunity for studying the chemical and biological qualities of the water in the tanks breeding *A. philippinensis* and comparing them with the conditions in the non-breeding tanks. The results of the chemical analysis of the water suggested that possibly the ratio between CO_2 and O_2 determined to some extent the suitability or otherwise of the water for *philippinensis* breeding. It was found that a high ratio of CO_2 : O_2 favoured breeding, and a low ratio was inimical to breeding. In this respect it may be pointed out that the condition is exactly the reverse of that affecting *A. culicifacies* breeding about which a report was made last year. It was also noted that in tanks where large numbers of Euglena or Macrocystis were present *A. philippinensis* larvæ were entirely absent. Whenever the larvæ were detected a careful search for these was also made but neither of them could be found. It is not possible at present to say what the explanation for this inverse association between *A. philippinensis* breeding and the breeding of Euglena is, but further studies are in progress and it is hoped that they may throw some light on the subject.

Rice cultivation and A. philippinensis breeding.—For the past three years systematic larval catches have been made from the paddy fields surrounding the malaria centre to see if *A. philippinensis* the carrier species breeds in these at any time during the year. In spite of the fact that 1938 was an epidemic year and *A. philippinensis* was found breeding profusely in most of the tanks, dobas and borrowpits it was never found on any occasion in any of the paddy fields examined. This suggests that paddy cultivation so far as these villages are concerned, is not a source of carrier anophelines. The chief source appears to be the tanks and dobas and borrowpits.

Factors concerned in the susceptibility to Kala-azar.—The factors concerned in susceptibility to kala-azar are not yet fully understood. It has repeatedly been declared by several reputed kala-azar workers that these factors require to be studied. The late Cols. Knowles and Acton after years of investigation on kala-azar stated that unless these factors were properly understood the kala-azar transmission problem could never be solved. All attempts by workers in the kala-azar Commission and Tropical School of Medicine to transmit kala-azar to healthy human volunteers through the bite of infected sand-flies have proved unsuccessful. Their failure is not surprising if it is remembered that even after injecting massive doses of *L. donovani* in either of the two forms in which it is known to occur, healthy man fails to contract the disease. Yet in nature man suffers from kala-azar. One plausible explanation for this is that only under certain conditions, man becomes susceptible to kala-azar and develops the disease. If it is so one has to define clearly what the nature of this susceptibility is and what factors are concerned in bringing it about. Evidence has now been accumulated to justify the conclusion that susceptibility to kala-azar is possibly associated with certain biochemical and cytological alterations in the body induced either as a result of endocrine or metabolic disturbances or as a result of certain infections such as malaria and typhoid. This aspect of the problem was therefore studied during the year. Mice and rats kept on various deficient diets were tested for their susceptibility to infection with *L. donovani* and the results compared with normal animals. This work is still in progress and interesting results are expected.

Acknowledgments.—For help and co-operation received thanks are due to Lt.-Col. A. C Chatterjee, Director of Public Health, Bengal; Bt.-Col. R. N. Chopra, Director, Calcutta School of Tropical Medicine; Dr. L. E. Napier, Professor of Tropical Medicine; Dr. R. B. Lal, Director, All-India Institute of Hygiene and Public Health, Calcutta; and the staff of the Department of Malariology and Rural Hygiene, All-India Institute of Hygiene and Public Health, Calcutta.

REPORT OF THE PROFESSOR OF BIOCHEMISTRY AND NUTRITION.

(G. Sankaran, M.B.B.S.)

The writer has been in charge of the work of the Department from 28th February 1938, when Dr. H. E. C. Wilson left India to take up a post in Glasgow. From 1st March 1938 to 31st October Dr. M. Narasimha Rao had been helping in the Department as Medical Assistant. Dr. Bashir Ahmad, the Assistant Professor, returned to duty on 22nd December 1938, after having been to America and Europe on a Rockefeller Fellowship. Dr. D. D. Mitra continued his work as Field Worker under the I. R. F. A.

The close co-operation that existed between the work of this department and the Nutrition Research Laboratories, Coonoor, has been greatly enhanced by the appointment here of the writer, who, since the days of Sir Robert McCarrison, had been associated with that laboratory. The change in the head of the department has naturally resulted, to quote the words of my predecessor, in the work carried out during the year being more of the nature of initiation rather than one of accomplishment, and in that light this brief report should be viewed.

The activities of the department may be grouped under three heads:—(1) Teaching, (2) Research and Investigations, and (3) Collaboration with other departments of the Institute and local Medical Institutions.

Teaching.—The syllabus for D. P. H. and D. M. C. W. candidates includes a course of fifteen lectures and five demonstrations on the physiology and biochemistry of Nutrition and its application to human dietetics and disease. In view of the enormous progress in this science in recent times, it was thought that the number of lectures should be increased. Even doubling the number of hours of the course would hardly be sufficient, but as the primary object of the syllabus is to meet the needs of the Public Health Officers and as the course for these candidates is already burdened with a heavy programme of the other subjects, the number of lectures has been raised to only twenty-four, and demonstrations to eight. One important idea behind the increased lectures and demonstrations has been to stimulate the would-be health officers to contribute to research on the problems of Nutrition peculiar to India and particularly from the standpoint of a field worker.

Research and Investigation.—Under this section is included work carried out in the field and in the laboratory.

Field Work.—*Vitamin A Nutrition of Prisoners in a Calcutta Jail.*—The visual photometer devised by the writer while at Coonoor has been further improved and constructed locally and made use of in this study. The instrument is a form of Birch-Hirchfield photometer with certain improvements. Mercury switches have been incorporated to enable the current to be turned on or off silently. This enables the worker to check the answers given by the subject without the letter knowing of the changes effected in the circuit. The Goldberg wedge has been replaced by an ordinary photographic plate on which are

developed several strips of emulsion in graded intensities of grey to dark opaque. This renders the spots more definite to the observer where as in the Birch-Hirchfield type various sizes of crescents are seen which may sometimes be confusing. A long lever has been fixed to the iris and the diaphragm measurements are more easily and accurately read off. The source of illumination for bleaching the visual purple is a 500 c.p. bulb inside a large opal dome, and the time taken is only fifteen seconds, so that a larger number of individuals could be examined in an hour than by the other methods—an advantage particularly in field work. With this instrument some 600 convicts of the Alipore Central Jail, Calcutta, were examined in the prison. Of these 500 belonged to the lower division file and 100 to the higher class file. The difference of the two groups was mainly one of better class diet given to the latter. On statistically analysing the results obtained, it was found that 43 per cent. of lower class group and 17 per cent. of the better class group showed a high degree of vitamin A deficiency. If dryness of the conjunctiva and Bitot spots were taken as an index of vitamin A deficiency, only 16·8 per cent. of the lower class and 15 per cent. of the higher class could have been diagnosed clinically.

To a group of 54 unselected persons detected as Vitamin A' deficient by the photometer, Vitamin A concentrate (kindly supplied by the Bengal Immunity Co.) was administered in 10,000 units daily to determine the time and rapidity of improvement. The photometer recorded the improvement in almost all the cases and within seven days they showed normal values, but in six cases administration of vitamin A concentrate was necessary for nearly three weeks before the photometer recorded normal values.

It is proposed to extend such investigation to other sections of people such as printing shop workers, sailors, school children, etc.

Angular Stomatitis.—While studying the Vitamin A subnutrition in the jails it was necessary to make a fairly comprehensive clinical examination of the prisoners with regard to other signs of malnutrition. The condition known as angular stomatitis was noticed quite often among the third division prisoners. It is usually associated with rawness of the tip and sides of the tongue, as well of certain muco cutaneous junctions such as the prepuce and the anus. Further investigation into the incidence of this condition elicited the information that it was a well recognised condition among convicts and the prison medical authorities have been promptly noting the conditions as soon as it appeared in the case records. We have examined the records of the prisoners at the Alipore Central Jail for the past three years 1935-38. In all about 1,520 cases have been recorded and it was noticed that the symptoms have a seasonal variation, increasing in the winter period from November to February, and decreasing in the summer months. Vitamin A concentrate administered to eleven typical cases of angular stomatitis had no effect on the condition. If any dietetic factor is concerned in this disease it is difficult to explain the seasonal variation in the incidence when the jail diet remains practically constant throughout the year.

Diet Survey.—This work is a continuation of similar surveys in various parts of Bengal and Assam. The information that is being gathered slowly, will help in our obtaining a full picture of the nutritional state of the various sections of the people in Bengal and Assam.

During this year the following places and types of people were studied, Dinajpur (Bengal) peasants, Jorehaut (Assam) industrial workers and Calcutta Marwaris (or business men). The classes of people are very widely diversified and form interesting contrasts.

The Dinajpur peasants mostly till their own lands, but the poorer of them find work in the farms of the well-to-do neighbours where they are paid mostly in kind such as chiefly rice, a little dhal and some mustard seeds, all produce of the soil. All of them usually lead a hand to mouth existence typical of simple rural life in Bengal. The industrial workers of Assam were selected from among those working in the tea gardens and tea factories. Men, women and children of the family are all earning members. Men are paid about 8 to 12 per month, women from 6 to 10 and children from 3 to 4 rupees. This class of people take life more easy and spend a portion of their meagre earnings in alcoholic drinks. The Calcutta Marwaris are all business men and in a sense well-to-do. The average monthly earning of each of the families examined was about Rs. 1,000 and none earned below Rs. 200. They are vegetarians strictly speaking lacto-vegetarians—and consider it *infra dig* to consume vegetable oils, and use the more expensive form of fat ghee for all cooking purposes. The Marwaris are also a conservative class of people as they would not afford facilities for a dietetic survey. It was for this reason that only seven families could be studied where as in Dinajpur and Jorehaut nearly forty families were easily available for the investigation.

The diet of the Dinajpur peasants is deficient in total calories, fat, calcium, vitamin A, and specially animal proteins. The Ca: P ratio is unsuitable for calcium assimilation. Jorehaut workers are in a similar state of nutrition only the degree of deficiency is not as great, with regard to certain factors such as minerals and vitamin A. The habit of drinking crude fermented liquors might perhaps add to the intake of vitamins of the B group present in yeast.

The Calcutta Marwaris in spite of their good income show a deficiency of animal protein in their food. The only source of animal protein for them is the milk. The chief source of fat is ghee or clarified butter. The Ca: P ratio is of normal value for proper assimilation of calcium.

Clinical signs of deficiency.—Large number of children were examined for these in Dinajpur and Jorehaut. Of the 1,224 examined in Dinajpore about 6 per cent. showed angular stomatitis, 1 per cent. phrynoderna, 1 per cent. Bitots spots, 20 per cent. caries of teeth, 10 per cent. malocclusion of teeth and 15 per cent. enlarged tonsils. Since Mohammedans examined were nearly 50 per cent. of the total, the figures were examined, to see if there was greater incidence in any of the two major communities. It was found that the percentages were the same in both the groups. The girls formed about 25 per cent. of the total examined and showed clinical signs in the same percentage as boys in all except one sign. The percentage of girls with enlarged tonsils was twice that of boys with enlarged tonsils. This ratio was found both among Hindus and Mohammedans.

The A. C. H. index selection taken to indicate a state of malnutrition showed that 40 per cent. of the boys and 50 per cent. girls were selected.

Of the 1,096 children examined from Jorehaut, Assam, 1 per cent. showed angular stomatitis, 1 per cent. phrynoderma, 2 per cent. Bitot

spots, 20 per cent. caries of teeth, 10 per cent. malocclusion of teeth and 12 per cent. enlarged tonsils. We notice once again in Assam twice the percentage of enlarged tonsils among girls as compared with boys.

The A. C. H. index selected 49 per cent. of the boys and 62 per cent. of the girls.

The value of intradermal test for vitamin C in field work.—The recent introduction of an intradermal test for vitamin C deficiency by Rotter was considered a very useful one for large scale examination of people in the field, as it is much quicker and simpler than the saturation test of Harris and Ray. We therefore decided to try the test on normal persons. Quite at an early stage of our investigation it was noticed that there was great variation in the time of bleaching of dye under the dermis on the same person on different days, and on different arms of the same person and injected almost simultaneously. It was therefore necessary to ascertain the real value of the test.

Four scientific members of the Department including the writer volunteered to be experimental subjects. The excretion of ascorbic acid in the urine was determined for each. In view of the fact that vitamin C deteriorates rather rapidly in warm climates in spite of organic acids like acetic acid being added as a preservative, the volunteers estimated the ascorbic acid in urine immediately after voiding by a simple titration method, that was devised for a similar investigation at Coonoor. The method is simple enough to enable one to do it even at home in less than five minutes for each estimation. Thus the daily excretions could be determined with care and accuracy. On the days that ascorbic acid in urine was being examined two intradermal injections, one in either forearm of 0·01 c.c. of a 0·04 per cent. solution of 2 : 6 dichlorophenol indol were given and the time required for complete bleaching noted. The volunteers were then given by mouth pure ascorbic acid until urine examination showed a saturation of it in the body. Then additional ascorbic acid was stopped and urine examined till they reached a normal value. We have by this means several levels of ascorbic acid in the body and for each of these states the time of bleaching of the dye was obtained. The results, however, indicated no correspondence between the time of bleaching of the dye and the level of ascorbic acid in the body. Hence the test as described by Rotter is not reliable as a test of vitamin C sub-nutrition. Further there was one constant and unpleasant sequel of these inoculations that has not been recorded by other workers with this test. Some ten days after the inoculation the site becomes intensely itchy and a raised tender papule is formed with redness for nearly an inch all round. This inflammation persisted for nearly ten more days and slowly resolved itself leaving a hardened nodule for another week or so.

Since the test appears to be theoretically sound it was considered desirable to study the problem in greater detail. Guinea pigs were inoculated in the paw of the feet and the test seemed workable with animals as well. Eighteen guinea pigs were divided into two groups and were maintained, one on a control and the other on a scorbutic diet. At frequent intervals the period for bleaching of dye was determined for all the animals. The scorbutic group lost weight rapidly, developed typical symptoms of scurvy and died in due course, yet the test time showed as erratic a fluctuation as in the case of the control group.

The failure of the test is perhaps due to two factors that could not be controlled by the technique employed. One is the very minute amount of dye that has to be accurately injected and the other is having to inoculate intradermally every time correctly. With a tuberculin syringe to inject, 1/100 of a c.c. an error of even 50 to 100 per cent. might be introduced, and one cannot be sure of the depth of the needle every time. To avoid the former defect the writer devised a micrometer syringe where 1/100 of a c.c. could be inoculated with an error of less than one per cent. Even with this instrument the test was as erratic, so that what appears at first sight a very useful test for sub-clinical cases that could be employed in the field has been found to be unsatisfactory.

Studies on hæmoglobin in anæmia.—In the reports of the previous two years reference has been made to study of hæmoglobins in anæmias. Further work was done on this subject from a new angle. Hæmoglobin possesses the property of absorbing certain portions of spectrum of light giving rise to two absorption bands called α and β bands. When blood is saturated with oxygen, hæmoglobin occurs as oxyhæmoglobin and the more prominent of the two bands α band in man shows a maxima at 5,769 A. U. But if oxygen is displaced by carbon monoxide the carboxy hæmoglobin formed, shifts that α absorption band to the violet end with the maxima at 5,709 A. U. The shift of 60 A. U. units is termed " span " by Barcroft. This " span " is specific for each animal and in the same animal Barcroft has shown that the shift has a direct relation to gaseous concentration of the hæmoglobin. It has also been shown that gaseous concentrations of hæmoglobin vary in health and disease. Thus Tikarezek has brought evidence both in man and in experimental animals, that anæmia is associated with a shift of the gaseous dissociation curve of hæmoglobin. It was therefore considered desirable to study the " span " in cases of anæmias with the hope that it may help in determining the degree and type of anæmia.

In all 110 cases of anæmias comprising the various types, hyperchromic, normochromic and hypochromic were studied. Each type was further classified according to mean corpuscular volume as macrocytic, normocytic and microcytic using the normal values given by Napier and by Wintrobe. Fluctuations in the values of the span were observed but no significant correlation with the type of anæmia could be obtained. Attempts were also made to find out whether there was any relation between the concentration of the hæmoglobin in the blood and the span. Even here no correlation was found to exist between the two. The hæmoglobin in the blood was estimated by means of the Pulfrich photometer. This instrument is now being used in the laboratory in all colorimetric quantitative determination and thereby all standard solutions are dispensed with.

Red Blood Corpuscles Diameter.—The determination of mean red blood corpuscle diameter has been so tedious a process that very few laboratories devoted to research on blood diseases adopt it as a routine procedure. However it is a very useful one. The red blood corpuscles of the blood may be likened to coins produced by a mint—the hæmopœtic system. In normal healthy individuals the coins are uniform as the mint is working efficiently. In anæmias the coins are of varying sizes and a study of the distribution of these sizes is a good

index of the efficiency of the mint—the hæmopœtic system. The introduction of a simple device by the writer last year has enabled us to study the red blood corpuscles diameter in a manner that could not be considered tedious. Before any studies on anæmic bloods could be made for their red blood corpuscle diameters it is necessary to have standards of normal persons. Such standards are available for persons of European nationality. With regard to the Indians not much information is available except some in South India. A series of fifty persons were chosen from various occupations namely students, doctors, laboratory assistants and mechanics. Their blood samples were taken under standard conditions. Increased accuracy in the results was obtained by determining red blood corpuscle diameters at intervals of 0·25 μ instead of 0·5 μ as was done at Coonoor. The results showed that the mean red blood corpuscles diameter of Bengalee Hindus was 7·28 μ which is larger than the average for South Indians (6·85 μ). The European average is 7·202 μ.

Statistical constants have been worked out to enable us to determine the limits of normality.

A large number of anæmic blood films have also been examined and in several cases where blood cell volume figures did not enable a definite diagnosis the Price Jones curve and mean red blood corpuscles diameter has been quite helpful. Some 25 cases of pregnancy anæmia were studied. The results suggested that they were not of a true microcytic type.

Studies in Calcium Metabolism.—Deficiency of calcium is now recognised as common in Indian diets, and a study has been made of the effects of these on bones and teeth. Three types of Indian diets (1) Good North Indian, (2) Well-to-do lactovegetarian and (3) Poor Indian, were fed to groups of rats. They represent varying levels of calcium intake in a descending order from good North Indian diet to poor Indian diet. They were compared with a control group fed on a well balanced diet. Each group was made to bear its litter to enable the study to be continued over three generations. The bones and teeth were examined by four methods. (1) X-ray pictures, (2) chemical analysis of bone and teeth, (3) histological and (4) microincineration of histological sections.

The X-ray pictures, all taken under standard conditions of exposure showed lighter shadows as calcium intake was decreased. The chemical analysis showed that the percentage of ash from the bones decreased with lower calcium intakes. In the case of teeth, however, the percentage of ash remained more or less constant in all the groups. The calcium phosphate ratio remained practically constant both in bones and in teeth in all groups.

Histological examination of bones revealed no differences in the groups but striking differences were noticed in the structure of the teeth. The width of predentine in normal group was from 16 to 20 μμ. in North Indian diet group 28 to 35 μμ in well-to-do Lactovegetarian 40 to 45 μμ and in the poor Indian group 45 to 52 μμ.

Microincineration of histological sections and examination of ash left, under dark ground illumination is an excellent method for the study of inorganic constituents in cells. The method is simpler and

quicker than the histological one and one can easily identify the various areas of dentine and predentine. This technique has been used with great effect in this study.

McCollum's observation on the " line test " was adopted by Steenbock and his co-workers for the routine testing connected with the study of vitamin D and calcium metabolism. The measurement of the width of the predentine or odontogenic zone of histological and microincinerated sections appears to be better for quantitative work on calcium metabolism. It may be that an examination of deciduous teeth by these methods can be utilised for gauging the previous nutritional history of the child with regard to calcium and phosphorus.

One observation of importance that has emerged from this investigation is that even the North Indian diet which is considered to be ideal is inferior to the stock diet if the histological picture of the teeth is investigated.

Mr. Mullick a post-graduate worker of this department carried out the work of this investigation under the direction of the writer and has submitted a thesis on this for the Ph.D. of the Aberdeen University.

A working hypotheses that the cells constituting the predentine act as a barrier in the transference of calcium and phosphorus from the general circulation into the dentine is being investigated by physico-chemical methods and it is proposed to extend these investigations by using tissue culture technique.

Spectrographic work.—For regular work on spectrograph, it was found that the air cooled high tension transformer usually supplied with spectrograph equipment was not suitable for our purpose, because of two reasons. In the first place, it does not give satisfactory service in a hot and moist climate. In the second place, range of variation in potential is limited, and could not be used for tungsten spark requiring 1,200 volts and for a hydrogen discharge lamp requiring only 4,000 volts. These difficulties were overcome by getting an oil immersion transformer made locally with a range of pressure from 4,000 to 15,000 volts, delivering 50 M.A. at the highest pressure.

Our experience in spectrography in connection with biological problems suggests that equipment capable of large dispersion in ultra-violet region alone cannot meet all purposes, because for a large number of important problems which are rapidly increasing good dispersion in visible and in intra-red region is equally necessary.

Vitamin A content of Fish oils.—Quantitative estimation of vitamin A in fish oils has not been carried out in Northern India to the extent which such studies merit particularly in Bengal where fish forms an important item of diet. The League of Nations Nutrition Committee has recently accepted a spectrophotometric assay for determining the Vitamin A content in terms of International Units. The absorption co-efficient of a 1 per cent. solution of the non-saponifiable portion of the oil in cyclo-hexane in 1 cm. cell at 3,280 A.U., multiplied by a conversion factor of 1,600 gives the Vitamin A content in International Units per gram. By the above technique a number of oils obtainable

from some 15 varieties of local fish have been examined. The oils were prepared in the laboratory by cold extraction of the fatty tissue with ether after mincing and drying them with sodium sulphate. This method prevents any loss of the vitamin. Three types of oils, body oils, depot oils and liver oils were examined separately. The body oils and depot oils were very poor sources of Vitamin A while the liver oils examined contained more Vitamin A than that present in an ordinary brand of Norwegian cod liver oil. The liver oils of two varieties of fish namely—" Air " and " Boal " had a vitamin A content nearly half of that in Halibut liver oil, and twenty-five times that of ordinary Norwegian cod liver oil while liver oils from " Dhain " and " Shole " were nearly equal to Halibut liver oil. It would thus appear that an industrial exploitation of Bengal fish liver oils is a feasible proposition.

The various samples of oil have also been examined by the colour reaction with antimony trichloride and the Carr-Price values have been calculated. The spectrophotometric and the colour reaction methods gave concordant results. For comparing the colour intensities with antimony trichloride the Lovibond tintometer and the Pulfrich photometer were used.

The fish examined were all caught in fresh water. Some are of estuarine habits living mostly in sea but coming up to fresh water during spawning season. The differences in Vitamin A content according to habitat, *i.e.*, fresh water or sea water; stage of development of the fish, and season are being investigated.

Lovern, Morton, Edisbury and others have recently brought forth evidence with regard to the existence of a new type of Vitamin A described as Vitamin A_2 and characterised by absorption bands at 348 and 280 and the blue colour with antimony trichloride having an absorption band at 690. They have further stated that this Vitamin A_2 is present in large amounts in fresh water fish liver oils. The fresh water fish liver oils examined here did show the typical absorption of Vitamin A_2. The relative quantities of the two types of Vitamin A present in various fish oils are being determined. It is likely that this investigation might throw some light on the controversy regarding the habitat of certain varieties of fish.

Absorption Spectra of Mustard oils.—In conjunction with the Epidemic Dropsy Enquiry under the Director, Dr. Lal, an investigation was made with the purpose of distinguishing good mustard oils from oils that are responsible for producing Epidemic Dropsy. The technique of absorption spectrophotometry was applied to a number of samples of oil obtained in the field. The results showed that in a 1 per cent. solution in alcohol a majority possessed a type of selective absorption and an examination of the curve revealed the presence of a broad band with a maxima at 2,750 A.U. The extinctive co-efficients at this wave length bear a certain amount of correlation with the epidemiological histories of the oils. Allylisothiocyanate a common adulterant in mustard oils does not possess the specific absorption at 2,750 A.U. Since more recent studies have indicated that the source of the poisonous substance in the mustard oil is *Argemone maxicana*, spectrographic examination of oil from the seeds of this plant was made. It showed two prominent bands one at 3,300 and another 2,750. However Argemone Mexicana oil when mixed with pure mustard oil in 5 per cent. and

10 per cent. ratio the spectrographs showed a striking resemblance to a known potent mustard oil with an absorption band at 2,750 A.U.

Several unsaponifiable fractions from the various oils as well as certain other crystalline products isolated from them have been examined spectrographically. Fuller details are discussed in the Epidemic Dropsy Section.

Absorption Spectra of Sera.—The sera obtained from normal persons and epidemic dropsy patients were examined for absorption of ultra-violet. The difference observed between the two could be explained as being due to variation in albumen-globulin ratio, which could be determined from the values of extinction co-efficient obtained before and after half saturation of the serum with ammonium sulphate.

Detection of Sulphanilamide Poisoning.—Since a certain number of patients using sulphanilamide preparations have developed severe types of anæmia the popularity of these drugs has greatly suffered. The anæmia is due to the formation of sulph-hæmoglobin in the blood and this substance can easily be detected by the spectrograph as it gives specific absorption at 6,200 A.U. The blood of a group of patients receiving diaminodiphenyl sulphone glucoside were examined daily and it was noticed that sulphœmoglobin could be detected about six days after the start of treatment and a week before any clinical signs of anæmia could be observed. It would thus appear that a spectrographic examination of blood will be a useful guide in the chemotherapy with sulphanilamide derivatives. It is interesting to record that in meningitis patients large doses of the drug were administered without the appearance of sulph-hæmoglobin in the blood.

Emission spectra of urines and bloods.—For X-ray examination of the alimentary system a barium meal is given. It was considered desirable to know if any barium compounds found their way into the blood or urine. For this purpose the blood and urine of patients who had been given a barium meal were collected and evaporated to dryness. The residues were placed between graphite electrodes at 15,000 volts 50 milliamps or 220 volts at 6 amps and spectrographs obtained were examined for lines characteristic of barium. In no case could a trace of the element could be detected. Barium compounds are not apparently absorbed from the intestines when a barium meal is taken for X-ray examination.

Collaboration with other workers.—In the short period that the writer has been working at this Institution he has had the pleasure of meeting a large number of workers with whom he discussed problems of mutual interest. Many sought our help and collaboration with their investigations by methods that were being developed in our department. In several cases pressure of our own work and lack of sufficient staff prevented us from more fully co-operating with them. Particular mention should however be made of active participation with certain investigations and workers. The splendid lead given to the problem of Epidemic Dropsy by the Epidemiologists has shifted the burden on to the Biochemist. Besides the investigations mentioned previously we collaborated with them in developing a fluorescence test for potent oils. Fluorescence work has been undertaken with a view to identify potent oils. Details of the work will be found in the report on Epidemic Dropsy.

To the Director, School of Tropical Medicine, Col. Chopra, we extended the facilities of our department by taking charge of an Endowment scholar working with our spectrographic equipment.

We have collaborated with Dr. Napier in his hæmotological work and the special methods of our study of red blood corpuscles size have been made available to his workers.

A variety of other help has been rendered to a number of workers such as; devising particular types of diets for experimental animals; giving schemes for the method of assessing the state of nutrition of individuals; preparation of collodion filters; and offering suggestions over methods of electrophoresis, etc.

In conclusion the writer would like to place on record the help he has received from every one around him which has considerably lightened his task. He would like particularly to thank the Director, Dr. Lal, for his hearty co-operation in furthering the schemes of work and providing all facilities particularly laboratory equipment. To the Director, School of Tropical Medicine, Col. Chopra, I.M.S., he is indebted for assistance rendered by various members of his institution. The department of Physical Chemistry, University College of Science has been kind in repairing some pieces of instruments. Dr. K. S. Krishnan of the Indian Association for the Cultivation of Science has greatly helped us in matters pertaining to theoretical physics. We can hardly overestimate the value of the expert statistical analyses and interpretation of quantitative data by the Department of Vital Statistics and Epidemiology. Lastly it is a pleasant duty to acknowledge with thanks the loyal and diligent service rendered by all the members of the Department.

REPORT OF THE PROFESSOR OF SANITARY ENGINEERING.

(Mr. P. A. Midha, M.Sc., M.Eng., M.I.Struct.E.)

Staff.—The Professor joined his duties on the 17th March 1938. On the 31st March, he proceeded on tour out of India, under a Rockefeller travel grant, to study rural sanitary engineering work in Turkey, Greece, and Jugoslavia. After an absence of three months and a half, he resumed his duties at the Institute on the 15th July 1938.

No subordinate staff has yet been appointed, but steps are being taken to fill the vacancies.

Teaching.—The last batch of D.P.H. and D.P.H. & Hy. students who passed out in September 1938, attended a full course of lectures and practical demonstrations in Sanitary Engineering for which provision existed.

In addition, the students carried out a sanitary survey of a portion of the town of Baraset, 24-Parganas, during the two days allotted for the work, in the month of Septmber.

A post-graduate student of Malariology of the 1938 session attended a course of special lectures on "Engineering Methods of Malaria Control" from 5th January 1939 to 10th January 1939.

Syllabus.—A revised syllabus in Sanitary Engineering has been prepared in consultation with the Director, and the views of Mr. Brian R. Dyer of the Rockefeller Foundation have also been obtained in this connection. In re-writing the syllabus, special care has been taken to avoid overlapping and duplication with the work of other professors and to make the course as practical and useful as possible, due emphasis having been laid on the rural aspects of the subject.

Equipment.—Steps are being taken to obtain necessary equipment, and although owing to certain unavoidable difficulties very little apparatus has yet been received, it is hoped that next year will see the laboratory and museum adequately equipped for teaching and research.

Already some useful technical literature, drawings and plans have been procured from various sources in and outside India, and further enquiries are being addressed in this connection.

Proposals for developments.—Proposals have been formulated for organising special courses for malaria engineers, municipal engineers, and other classes of workers who might participate in the improvement of environmental hygiene.

Plans are also being drawn up for a scheme of sanitary improvement works which could be introduced in rural and semi-rural areas.

These schemes will necessitate substantial additions to the staff and equipment of the department, but would, if accepted, bring the department in line with the Sanitary Engineering departments of Public Health Institutes in other countries, and vastly improve its range of usefulness.

Acknowledgments.—The Professor offers his personal thanks to Dr. W. P. Jacocks and the authorities of the Rockefeller Foundation, International Health Division of New York, for the award of a travel grant to him in connection with his European tour mentioned above, and also to all the eminent doctors and engineers who conducted him during the tour and with whom he came into contact.

The tour, though short, proved immensely useful and instructive to the Professor, particularly in the field of malaria engineering and general rural sanitation, and furthermore it helped to give a new outlook on the work which he has now in hand in the Institute.

His thanks are also due, among others, to the Chief Engineer, Public Health Department, Government of Bengal, Mr. D. E. Wright, Sanitary Engineering Adviser, School of Hygiene, Ankara (Turkey), Mr. Milivoji Petrik, Chief Sanitary Engineer, School of Public Health, Zagreb (Jugoslavia), and Dr. W. C. Sweet of the Rockefeller Foundation, for the free presentation by them of valuable technical literature, drawings, plans, etc., to the department.

REPORT OF THE MATERNITY AND CHILD WELFARE SECTION AND WELFARE CENTRE OF THE ALL-INDIA INSTITUTE OF HYGIENE AND PUBLIC HEALTH FOR THE YEAR 1938.

On April 1st, 1937, this department was taken over by the Government of India, but as no Professor was appointed, Dr. M. I. Neal-Edwards, an officer of the Women's Medical Service, continued to act in that capacity till the end of February 1938. Dr. S. Pandit, a temporary officer of the Women's Medical Service, who was working as the Senior Research Assistant to the Indian Research Fund Association, carried on the work of the department for the month of March 1938. In early April, Dr. Jean Orkney's services were lent to carry out the duties of the Professor till the end of June. An Assistant Professor was appointed by the Government of India at the beginning of this month.

Teaching.—One student joined the D. M. C. W. course, 1937-38, and was awarded the diploma. One student started the course in 1938.

The hospital facilities available for the post-graduate training continue to be inadequate. Measures to provide better facilities are under contemplation.

D. P. H.—The usual lectures and demonstrations in Maternity and Child Welfare and School Hygiene were given to the students taking this course.

The Maternity and Child Welfare Centre.—The activity of the centre is confined to that portion of Ward VIII which is bounded by College Street on the east, Kolutola Street on the south, Chitpur Road on the west, and Mechuabazar Street on the north. The population of the area (from the 1931 census) is 48,998.

The organisation and general activities of the centre were described in an appendix to last year's report.

The total clinic attendance of ante-natal and post-natal cases, infants and toddlers, during the year was 8,456—an average weekly attendance of 163 as compared with 172 last year. A total of 7,500 home visits were paid by two health visitors, an average of 313 home visits by each health visitor per month; 202 ante-natal visits were paid by the midwives.

One of the midwives left at the end of February 1938 and it was not possible to appoint a successor during the year under review. Consequently, the midwifery work was handicapped.

The steady growth of the centre is resulting in the accumulation of very useful data.

Antenatal care.—541 women received antenatal care of which 72 or 13·3 per cent. were primigravidæ. The number of pregnant women at different age groups is as follows:—

13 to 15 years	9 (or 1·7 per cent. of total).
16 to 34 years	497 (or 91·8 ,, ,,).
35 years	35 (or 6·5 ,, ,,).

Of the total number, 346 (64 per cent.) attended the clinic, the remainder received domiciliary care only. The average weekly attendance of antenatal cases at the centre was 36.

Intranatal care.—Of the 541 antenatal cases on cards, 313 were delivered in the district. Of these 3 died—1 from puerperal sepsis, 1 from post partum hæmorrhage, and 1 from tuberculosis. None of these three women were delivered by the clinic staff. The attendance at delivery is as follows:—

By centre midwife	83=26·5	Per cent.
By other midwives	32=10·2	,,
In hospital or maternity home	57=18·2	,,
By private doctors	6=1·9	,,
By untrained dais or relatives	135=43·1	,,

The results were as follows:—

Full term deliveries	278=88·9	Per cent.
Premature deliveries	19=6·7	,,
Stillbirths	4=1·3	,,
Abortions	12=4·0	,,

Of the 83 cases delivered by the centre midwife, 80 were full term and 3 premature.

Postnatal care.—Postnatal care was given by the midwife for 10 days to the cases delivered by her, the health visitor visited three times during that period. Monthly visits were paid by the health visitor until the infant was one year old.

Mothers are encouraged to attend the clinic for advice and records are kept of their health and progress and that of their children until the children reach the age of 2 years. The average weekly attendance of postnatal cases at the clinic was 8.

Thus 83 mothers received complete care, *i.e.*, a minimum of 2 visits to the centre and monthly domiciliary advice by the health visitor during the antenatal period, internatal care by the centre midwife, postnatal care by the midwife, health visitor, and the doctor.

Infant care.—The total number of births coming to our knowledge was 496 of which only 78 per cent. had been registered. The unregistered births were discovered by the health visitors in the course of their visits. This information was supplied to the Municipal Health Officer. Of this total, 58 infants had died or had left the district before they could be visited and 4 others refused the visit. Seventy-eight infants who came to the district from outside were put on cards, giving a total of 516 infants, during the year.

Including the infants carried over from 1937, 858 infants were under care during the year of which 45 per cent. attended the centre and the rest received monthly home visits. The average weekly attendance of infants at the centre was 41.

There were 55 deaths among the infants on cards during the year.

The causes of infant deaths are given below:—

Prematurity	1
Pneumonia	19
Gastro-intenstinal disease	14
Umbilical infection	1
Small-pox	3
Measles	2
Tuberculosis	2
Congenital syphilis	1
Neglect or starvation	5
Diphtheria	1
Unknown	6
Total	55

Toddler care.—There were 514 toddlers on cards at the end of 1938, of whom 202 or 36 per cent. attended the centre, others were seen every three months by the health visitor at home. The average weekly attendance of toddlers at the clinic was 77. There were 31 deaths amongst the toddlers on card. The causes are as follows:—

Diarrhœa and dysentery	4
Pneumonia	6
Typhoid	2
Measles	3
Small-pox	7
Tuberculosis	1
Anæmia	1
Infantile liver	1
Septic infection	2
Accident	1
Cholera	2
Unknown	1
Total	31

Mothercraft class.—Group teaching on health subjects was carried out by the health visitors throughout the year except in the hot weather. Twenty-six classes were held and the average attendance was 8.

The nursery school for children between 3 and 5 years of age was held throughout the year. The average daily attendance was 16.

The staff of the welfare centre has done excellent work throughout the year. The increased work in the form of heavier clinic work, more home visiting and more detailed method of record keeping recently introduced, has been undertaken with energy and enthusiasm.

Complications of pregnancy.

Anæmia.—Mild degrees of anæmia were quite common. Complete blood examination of 35 pregnant women in whom anæmia was suspected

clinically, was done in connection with Indian Research Fund Association Enquiry. The results were as follows:—

Microcytic hypochromic anæmia	10
Macrocytic anæmia	2
Normocytic	8
Simple microcytic type of anæmia	2

The blood of the remaining thirteen cases proved to be normal.

Toxæmia of pregnancy.—There was one severe case of albuminuria, who on advice attended a hospital and gave birth to two live children. Nine mild cases of albuminuria were seen, of whom 8 delivered normally and gave birth to 6 full term and 2 premature live babies. One woman left the district.

Osteomalacia.—There was one case only; she was a Marwari woman who delivered normally.

Tuberculosis.—Nine cases of clinical tuberculosis were detected at the centre (8 pulmonary and 1 abdominal). Three of them were being treated by private doctors. Four were taking treatment either from some hospital or dispensary. Two women who would not go for any outside help for various reasons like purdah, want of time, etc., were treated at the centre with cod-liver oil and were given extra nourishment like milk. One of those who went to hospital, died during pregnancy. The remainder delivered at full term. The health of 6 women improved after delivery, but 2 were in a very poor condition. Of the 8 infants delivered by these women 6 were doing well, one had died at the age of 6 months and the other was in very poor health.

Syphilis.—The blood was examined for Wasserman reaction in 61 antenatal cases, 5 tests were positive, and 11 were doubtful. Nine patients were given treatment at the centre, of which one received free treatment.

Abnormal deliveries.—There were 10 abnormal deliveries amongst the cases seen antenatally, and delivered in the district; 3 were breech, 1 cæsarian for contracted pelvis, 1 antepartum hæmorrhage, 1 occipito-posterior presentation, 4 cases of postpartum hæmorrhage. Of the 541 cases on cards, 6 twin deliveries occurred—all the infants were born alive. Five sets of twins were full term and one premature.

Research.—(1) *The incidence of pyorrhœa in pregnant mothers.*—An analysis of the records of 360 pregnant women who were seen by the doctors of the clinic last year showed that the incidence of pyorrhœa was 35·5 per cent. The percentage of pyorrhœa cases amongst 112 Muhammadan women and 248 Hindu women was 27 and 38 respectively. Further analysis of Hindu cases according to province of origin did not show any difference.

(2) A study of old records of infant deaths is in progress. So far 216 cases have been investigated.

(3) The normal weight curve of the infants is being worked out. The average weight curve as obtained for 76 infants follows the one given by the Red Cross Society, Delhi, with only minor variations.

(4) The assessment of the nutritional condition of infants by a special marking method was undertaken in co-operation with the Professor of Nutrition. Thirty-seven infants were assessed. The work had to be suspended temporarily for want of time during clinic hours.

(5) The birth order of the antenatal cases attending the clinic from 1933 was investigated. 1,048 cards were examined. This investigation is being continued also.

(6) The work on "Vitamin C content of the pregnant mothers" was initiated. Forty-eight mothers were investigated using the intradermal test. As the results were unsatisfactory, the work was discontinued.

Papers published during the year:

Infantile mortality in India. *I. M. G. (under publication).*

PREGNANCY ANÆMIA AND TOXÆMIA ENQUIRY UNDER THE INDIAN RESEARCH FUND ASSOCIATION.

By

Dr. L. E. Napier.

In March, I took over charge of this enquiry from Dr. Neal-Edwards who was going on leave and not returning to her post.

The personnel of the enquiry consisted of two lady doctors, Doctors Dhramvir and Dei, the former of whom resigned in September, as she was getting married, and was replaced by Dr. Aggarwal, and Dr. D. Mukerjee, who obtained a higher-paid permanent appointment in October and was replaced by Dr. S. Mukerjee.

The work was continued on the lines laid down by Dr. Neal-Edwards. Cases of anæmia in pregnancy were obtained from different sources, complete blood examinations were done, and as far as possible the patients were followed up and revisited in their homes.

Since the beginning of the enquiry, 452 patients have been examined, and full blood counts done, and 743 subsequent visits paid to these patients; 513 blood counts were done during these subsequent visits. In addition to this 61 " normal " pregnant women have had complete counts done.

No attempt has yet been made to analyse the data, but this will be undertaken early next year.

REPORT OF THE TUBERCULOSIS INQUIRY, 1938.

(Financed by the Indian Research Fund Association.)

[DR. A. C. UKIL, M.B., M.S.P.E. (PARIS), F.S.M.F., F.N.I.]

The work carried out under this Inquiry may be conveniently grouped under the following heads:—

I.—*Tuberculosis in relation to industry.*

Survey in an industrial area.—In order to ascertain in what way the rural population of India is reacting to the industrial environment so far as tuberculosis is concerned, this inquiry is conducted amongst the workers in a Jute Mill 23 miles from Calcutta. Jute industry has been taken up first, because here is a monopoly industry in this part of the world which has not yet been investigated from the point of view of its industrial hazards. The mill employs nearly 5,000 workers, of whom 4,000 take part in the processes of jute manufacture. Of these, 3,307 are males and 665 are females. Half of the labour is recruited from Bihar and Orissa, 20 per cent. from the Central Provinces; about 10 per cent. each from Bengal and the United Provinces, the rest from Madras and some other Provinces. Thus it will be seen that a vast majority of the workers are drawn from quite distant areas of other Provinces. They keep contact with their village homes and visit the native place for a short period almost every year. It is thus evident that diseases acquired by the workers in the industrial area may be transmitted to the villages of their origin. Such transmission of Tuberculosis in an imperfectly tuberculised community (the village) may be extremely dangerous for these people. This investigation, therefore, serves double purpose. Firstly, to find out the hazards of this industry and secondly, indirectly to find out what amount of risk the villages of origin of these workers are running.

The investigation was directed in two lines: (A) A survey to determine the dusty nature of the industry, (B) A thorough examination of the workers. A brief statement of each is given below:—

A. *Dusty nature of the industry.*—The different processes in jute industry emit a large amount of dust. It is found, as determined by the dust counter (Bausch and Lomb), that the majority of the dust particles in various departments vary from 1 to 3 micra. The finest dust is detected in the "breaking" line and spinning sections. The concentration of dust is also highest in these sections (9·3 to 14·6 million particles per cubic foot of air). Chemical analysis of jute fibre done by other workers, has shown that it contains a very minute quantity of silica also.

Apart from the question of tuberculosis, it was thought that such minute dust at such concentration may produce pneumonoconiosis and cause disability to the workers. But besides mild bronchitis in about 75 per cent. of workers and jute dermatitis in about 4 per cent. no serious disability amongst the workers could be detected. It is possible that severely disabled workers had left work and had gone home without being noticed before or during the investigation. But this is not very likely.

B. *Examination of the Workers.*—It was thought wiser to conduct a very thorough examination in a representative sample from each department to get an idea of the industry, its hazards and to save money for wholesale radiological examination in the general survey.

Intensive study of sample workers.—Two hundred and sixty-three workers were selected from different departments of the industry according to the length of their industrial lives. The study consisted of: the previous life of the worker, age at entry; the duration of his industrial life and nature of work; previous illnesses and contact with tuberculosis cases; customs, habits and social environment; housing and other relevant points. Finally, they were submitted to a thorough examination—including physical and radiological examination and sputum and blood tests. It may be mentioned that great difficulty was encountered in inducing these ignorant and prejudiced workers to these examinations. It was particularly difficult to obtain sample of sputa from many of them.

It was found that 80 per cent. of the workers came from rural areas; 18 per cent. from semi-rural and only 2 per cent. from urban. The duration of industrial life varied as follows:—5 years—9 per cent.; 10 years—19 per cent.; 20 years—45 per cent.; 40 years—25 per cent., above 40 years—2 per cent. As the workers spent only short periods at home it will be seen that many of them had spent long periods in the industrial environment.

In assessing chest skiagraphs we have followed Cummins' method of assessing the extent, density and character of lesions and Cummins' modification of Irvine's classification for coniosis and tuberculosis.

Tuberculosis.—Cases of Tuberculosis were labelled as "Definite" and "Probable". Definite were those who showed tubercle bacilli in sputa and active infiltration in lung skiagraph. Probable were those whose sputa were either not available or negative but skiagraph showed active infiltration. On this basis 1·9 per cent. workers were detected as "Definite" and 5·3 per cent. as "Probable" cases of tuberculosis or a total of 7·2 per cent. Healed or arrested lesions in lung parenchyma or in tracheo-bronchial glands were detected in 59 per cent.

Clinical evidence of bronchitis was detected in 32 per cent., whereas exaggerated bronchial markings in skiagraphs were detected in 75 per cent. and arborization and small mottlings in 27 per cent. Jute dermatitis was found in 4 per cent.

Blood tests.—Von Bonsdroff's count, lymphocyte: monocyte ratio, and differential count were done in 225 of these workers. Marked pathological deviation was detected in 7·6 per cent. A milder deviation by V. B. count was found in 54·3 per cent. and by L/M ratio in 30·8 per cent. A considerable degree of Eosinophilia was detected in many cases, *e.g.*, 7 per cent. showed over 15 per cent. count 21 per cent. between 10-15 per cent., 32 per cent. between 5-10 per cent. and 40 per cent. less than 5 per cent.

Serial examination of the mill population.—Having finished this sample investigation all the available workers were taken up department by department. To date 1,851 workers of batching, preparing, spinning, winding and beaming departments have been examined. Except radiology the examinations were made as before as also Mantoux test with 1 in 1,000 of old tuberculin. Radiological

examinations were only done in " clinically suspected " cases and strong tuberculin reactors.

Tuberculosis.—It was found that 38 per cent. workers reacted positively to tuberculin, a figure which is much higher than what has been obtained by us in urban environment; 36 per cent. were strong reactors. It was of interest to note that several high reactors were traced to be in contact with infective sources.

The number of high reactors was 584 and there were 64 " clinically suspected " cases. Eighteen workers were both high reactors and " clinically suspects ". Amongst all these only 196 could be radiologically examined to date. The result is given below in tabular form:—

Groups of cases.	Total No. examined.	" Difinite " cases.	Per-centage.	" Pro-bable " cases.	Per-centage.	Total per-centage.
High tuberculin reactors.	152	8	5·2	7	4·6	9·8
Clinically suspected	26	8	30·7	2	7·7	38·4
Combined strong reactors and clinically suspected.	18	4	22·2	2	11·1	33·3

Though it is not intended to draw general conclusions at this stage yet the finding of 31 radiologically active pulmonary tuberculosis cases amongst the 196 persons from the selected group of 630 workers or a percentage of 15·8 per cent. is significant. If we assume that all the pulmonary tuberculosis cases occur in this selected group, the incidence for the whole population comes to about 5·4 per cent. This is a high figure. It is interesting to note that many of these were " silent " cases, *i.e.*, who did not either complain of any symptom or show any evidence of disease on physical examination but were sources of a danger to others.

Clinical evidence of bronchitis was detected in 307 (16 per cent.), Jute eczema in 227 (12·2 per cent.), and naso-pharyngeal catarrh in 57 (3 per cent.) cases. Such a high incidence of respiratory catarrh and eczema and a high degree of eosinophilia in blood have been significant findings in this industry.

Contact survey.—13 houses belonging to 4 " definite " and 9 " probable " cases, of whom 5 lived in a neighbouring village, have hitherto been surveyed. Among the contacts of these cases, 13 were children and 28 adults. All the contacts, children and adults, gave a positive tuberculin reaction. Among the 13 children, 11 gave a 3-*plus* and two 2-*plus* reaction, while of the adults, 3 showed a 4-*plus* reaction, one 2-*plus* reaction and the rest 1-*plus* reaction. One adult contact has shown clinical signs of disease. They are being X-rayed gradually.

Social background favouring diffusion of infection.—The housing condition is very unsatisfactory, diet is ill-balanced and inadequate. The average weekly income of a worker is about Rs. 2-5 but a large amount of this goes towards the payment of interests of previous debt. On top of these there are many other evil social customs which lower the resistance and help the dissemination of infection.

II.—*Tuberculosis in " Home Contacts ".*

210 children below 15 years have been examined and followed up since last year's conference, bringing the total to 827. Owing to the

difficulty of home survey of scattered houses and of bringing the contacts for X-ray and other investigations and to certain unavoidable difficulties about X-ray service in the hospital, the progress has not been as rapid as we would have liked it to be. It is proposed to raise the number of completely examined cases to 1,000 before final deductions are made.

Of these 827 children under investigation, Mantoux test (1 in 1,000 dilution) has been done in 754 and radiological examination in 619 cases. Both Mantoux test and X-ray examination have been completed in 546 cases. 643 children were in contact with "open" cases, 79 with "closed" cases and 105 with "unknown sputum" cases. The-last category included cases which were X-ray positive but where the sputum has not been examined and cases where neither sputum nor X-ray has been done but which had very suggestive history of the disease. Seven hundred and forty children had "intimate" and 87 "distant" contact. Mantoux test was positive in 69 per cent. (63 per cent. in "closed" case contacts, 69 per cent. in "open" case contacts, 73 per cent. in "unknown sputum" case contacts). Active tubercular pulmonary lesions were detected in 11·7 per cent. cases (8·4 per cent. in "closed" case contacts, 9·7 per cent. in "open" case contacts and 25 per cent. in "unknown sputum" case contacts). Healed or "arrested" lung lesions were noted on skiagraph in 6·1 per cent. and definitely enlarged hilar glands in 30·2 per cent. The differences in findings between the different categories of contacts are noteworthy but we would prefer not to offer an explanation now in view of the smallness of numbers under two out of the three categories. Forty-eight per cent. of cases showed radiologically demonstrable lesions.

"Intimate" contact showed a much higher number of reactors in the "open" source contact series than in others. The percentage of reactors increased in proportion to the length of period lapsing after the initial contact. The incidence of positive reactors was 88 per cent. in "active lesion" series, 85 per cent. in "arrested lesion" series and 72 per cent. in tracheo-bronchial adenopathy series. No evidence was obtained to suggest that the intensity of the turberculin reaction varied directly with the activity of the lesion. The percentage of positive reaction was found to vary *directly* with age, while the incidence of demonstrable lesions varied *inversely* with age, *i.e.*, the younger the age the stronger was the probability of tuberular lesions being present. The incidence of "active" parenchymal lesions increased with age up to 10 years after which it began to decline rapidly, while the incidence of "arrested" parenchymal lesions increased with age. The incidence of both "active" and "arrested" lesions in the "open" source series almost equalled that of the whole group. The incidence of infection, as detected by Mantoux test, was found to be 21 per cent. higher than that detected by radiography.

It has been noticed that the percentage of positive reactors and of detectable X-ray lesions increases with duration of contact with "open" cases. It has also been noticed that the maximum incidence of tracheo-bronchial adenopathy (as seen in chest skiagraph) occurred after 3 to 4 years' contact with "open" cases and in the 5 to 10 years age period. The highest incidence of positive tuberculin reaction among them also occurred in the same age period.

In all, 110 tubercular homes, containing 319 children have been surveyed, of which 94 contained " open " pulmonary tuberculosis cases. Sanitary condition was bad in 56 per cent. of the houses and 39 per cent. of the houses were one-roomed tenements. Forty-nine per cent. houses contained inmates with a low economic status (average income per head—less than Rs. 5 per month). Fifty-seven per cent. of the contact children lived in houses with bad hygienic conditions and 36·6 per cent. in one-roomed tenements. 196 out of 319 children slept in the same room with the patient. As a majority of the cases belonged to the poorer classes, no significant correlation could be found between the incidences of infection, morbidity rate and economic status. Tuberculosis mortality among child contacts was found to be 50 per cent. higher and adult mortality 3½ times higher than general mortality in these homes.

III.—*Typing of Tubercle Bacilli from Pathological Materials.*

Out of 218 strains isolated, 193 strains have been typed out. Of the strains typed out, *all of which have proved to belong to the " Human " type,* 125 have been obtained from lymphatic glands (cervical—68, tracheo-bronchial—36, axillary—7, inguinal—1, mesenteric—13), 2 from tonsils, 22 from cold abscess pus, 2 from urine, 4 from skin, 1 from stool, 1 from stomach wash, 29 from pleural fluid, 3 from sputum and 2 from lungs. 25 strains are awaiting typing. This line of work is being carried out in a mutilated form, only concerned with the study of strains obtained from infants and children and from skin and other rare non-pulmonary sources. Indian data on them are still lacking.

Out of a total of 159 non-pulmonary sources from which the strains were obtained, the age incidence was as follows:—

0-2 years = 6 or 4 per cent., 2-5 years = 4 or 2·5 per cent., 5-10 years = 8 or 5 per cent., 10-15 years = 13 or 8 per cent., 15-20 years—24 or 15 per cent., 20-25 years = 30 or 18·5 per cent., 25-30 years = 22 or 14 per cent., 30-40 years = 26 or 16 per cent., 40-50 years = 9 or 6 per cent., and above 50 years = 17 or 11 per cent.

IV.—*Miscellaneous Work.*

As usual, this department had to answer many enquiries from the heads of medical and public health administrations and from workers on tuberculosis. In addition to several courses of post-graduate teaching in tuberculosis and editorial aid, a note on " Tuberculosis in India " was prepared which was presented by the Public Health Commissioner with the Government of India at the May, 1938 session of the Office Internationale d'hygiene publique and which has been published in the September issue of its Bulletin. Help has also been given to the Director of Public Health, Bengal, in preparing schedules and plans and in giving advice for a tuberculosis survey in an urban and a rural area and to the Chief Medical Officer, Mines Board of Health, Asansol, for an investigation in the mining areas near Asansol. Considerable time was taken up in preparing notes and memoranda in connection with the All-India anti-tuberculosis scheme and with the proposed Tuberculosis Association of India and with regard to work in connection with the Tuberculosis Advisory Committee and Tuberculosis Survey Committee,

V.—*Staff and Organisation.*

The Officer-in-charge of this Inquiry has been a voluntary worker for the last 11 years. Of the paid workers, Dr. P. K. Sen, M.B., M.D., PH.D., T.D.D., is conducting the industrial tuberculosis inquiry with the help of a field worker, Dr. M. M. Bose, M.B., appointed during the year. Dr. S. R. Guha Thakurta, B.SC., M.B., with the help of the Laboratory Assistant, Mr. A. G. Sinha, has been in charge of the laboratory. He is also helping in the survey of " home contacts " of tuberculosis cases. They continue to render valuable assistance in connection with the work under this Inquiry.

I take this opportunity of expressing my indebtedness to Dr. R. B. Lal, Officiating Director of the Institute, for affording me accommodation and facilities for work at the Institute. I also desire to express my thanks to the authorities of the Calcutta Medical College and Hospitals and the Tuberculosis Association of Bengal for help in connection with this Inquiry.

The following papers were contributed by the workers of this Inquiry during the year 1938:—

(1) A tuberculin survey in a hill area in the Darjeeling district by Ukil, A. C., and Guha Thakurta, S. R., Proc. Indian Sc. Congr., 1938, p. 250.

(2) Tuberculosis among " home contacts " by Ukil, A. C., *ibid*, p. 250.

(3) The applicability of collapse therapy at the Outpatients' Section of a city hospital by Ukil, A. C., and De, K. N., *ibid*, p. 233.

(4) The influence of sunlight upon experimental tuberculosis by Ukil, A. C., and Guha Thakurta, S. R., Amer. Rev. Tuberc., April 1938.

(5) Some points in the diagnosis of pulmonary tuberculosis (adult type) by Ukil, A. C., Trans. Med. Coll. Re-Union, Vol. I, No. 1, 1938, pp. 95-99.

(6) Anti-tuberculosis work in Bengal by Ukil, A. C., Ind. Med. Gaz., Sept. 1938.

(7) Tuberculosis in India by Ukil, A. C., " Science and Culture ", Vol. IV, No. 5, 1938, and Bull. Office International d'Hygiene Publique, Tome XXX, No. 9, Sept. 1938, p. 2066.

(8) Industry and tuberculosis by Sen, P. K., " Science and Culture ", Vol. IV, No. 2, Aug. 1938.

(9) After-care of tuberculous patients by Sen, P. K., Trans. Med. Coll. Re-Union, Vol. I, No. 1, pp. 106-110, 1938.

(10) Marriage and Tuberculosis by Sen, P. K., Journ. Tuberc. Assoc., Bengal, June 1938.

(11) Some experience in Gold Therapy in Pulmonary Tuberculosis by Chatterjee, P. K., and Ukil A. C., Trans. Med. Coll. Re-Union, 10th Session, December 1938.

(12) Relapse in case of Pulmonary Tuberculosis by Sen, P. K., *ibid.*

SIXTH SESSION OF THE POST-GRADUATE COURSE IN TUBERCULOSIS, HELD AT THE ALL-INDIA INSTITUTE OF HYGIENE AND PUBLIC HEALTH, UNDER THE AUSPICES OF THE KING GEORGE'S THANKSGIVING (ANTI-TUBERCULOSIS) FUND IN JANUARY 1938.

By

Dr. B. K. Sikand.

Training of tuberculosis workers is a recognised activity under the Fund. Post-graduate courses have been organised since 1935 and 220 doctors have so far received training. The beginning of these courses was made at the All-India Institute of Hygiene, where with the help of the Director, the Tuberculosis Association of Bengal, Dr. A. C. Ukil and other tuberculosis workers, these courses proved a great success. The demand for similar courses increased considerably and these were therefore organised in other centres like Madras, Bombay and Lahore as well.

The sixth post-graduate course under the Fund started on the 30th January 1938. Thirty doctors had been selected with due regard to territorial distribution. The course lasted 4 weeks and the syllabus covered a wide range of subjects with special reference to the preventive aspect of the problem. The Fund as in previous years, charged no admission or tuition fees and paid each candidate 2nd class railway fare up to a maximum of Rs. 100.

The inaugural function of the course took place under the chairmanship of General Mills, Surgeon-General with the Government of Bengal. After a welcome address by the Organising Secretary of the Fund, General Mills in his introductory remarks referred to the social aspects of the problem and urged all the candidates to do all in their power to fight the disease. The inaugural address was given by Sir U. N. Brahmachari, who presented figures to show that, while tuberculosis was decreasing in other countries, it was increasing in India. He further pointed out the danger of spread of the disease with increasing urbanisation and industrialisation. He stressed certain essential points of a successful tuberculosis scheme.

All the candidates attended the classes regularly and made the best use of the opportunities offered to them. The success of the course was due to the help and co-operation that we received from Dr. R. B. Lal, Director, All-India Institute of Hygiene and Public Health, the Secretary, Tuberculosis Association of Bengal, Dr. A. C. Ukil, Dr. K. S. Ray, Medical Superintendent of Jadavpur Sanatorium and other tuberculosis workers.

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SCIENTIFIC CONTROL COMMITTEE.

Subject to the ultimate control of the Government of India, the scientific control over the Institute vests in the Scientific Control Committee, which also functions as the Recruitment and Appointments Board for the appointment of the professorial staff of the Institute. The membership of this body during the year under review has been as follows:—

1. The Hon'ble Member-in-Charge, Department of Education, Health and Lands (*Chairman*).
2. The Director General, Indian Medical Service.
3. The Public Health Commissioner with the Government of India (*Secretary*).
4. The Director, School of Tropical Medicine, Calcutta.
5. The Director, All-India Institute of Hygiene and Public Health, Calcutta.
6. The Hon'ble Mr. V. Ramadas Pantulu.
7. Dr. J. C. Ghosh, D.Sc., Head of the Department of Chemistry, Dacca University, Dacca.
8. Rai Bahadur Dr. B. N. Vyas, M.B., Consulting Physician, King George Medical College Hospital, 14, Clyde Road, Lucknow.

No meetings of the Committee were held during the year.

All-India Institute of Hygiene and Public Health, Calcutta.

Staff—1939.

Director.

Dr. John B. Grant, M.D., B.A., M.P.H. (from 3rd July 1939).

Dr. R. B. Lal, M.B.B.S., D.P.H., D.T.M. & H., D.B., F.N.I. (Officiating up to 2nd July 1939).

Assistant Director.

Captain K. Satyanarayana, M.B.B.S., A.I.R.O.

A.—Staff of the Institute.

Section of Public Health Administration—

Professor—

Dr. John B. Grant, M.D., B.A., M.P.H. (from 3rd July 1939).

Dr. R. B. Lal, M.B.B.S., D.P.H., D.T.M.&H., D.B., F.N.I. (Officiating up to 2nd July 1939).

Assistant Professor—Dr. S. G. Ghosal, M.B., D.P.H., D.B.

Section of Vital Statistics and Epidemiology—

Professor—Dr. R. B. Lal, M.B.B.S., D.P.H., D.T.M.&H., D.B., F.N.I.

Assistant Professor—

Dr. P. V. Sukhatme, B.Sc., Ph.D., D.Sc. (from 4th May 1939).

Mr. Satya Swaroop, M.A. (Officiating up to 3rd May 1939).

Mathematical Assistant—Mr. Satya Swaroop, M.A. (from 4th May 1939 to 24th June 1939).

Section of Biochemistry and Nutrition—

Professor—Dr. G. Sankaran, M.B.B.S.

Assistant Professor—Dr. Bashir Ahmad, M.Sc., Ph.D.

Section of Malariology and Rural Hygiene—

Professor—Dr. K. V. Krishnan, M.B.B.S., D.B., M.R.C.P., D.Sc., F.N.I.

Assistant Professor—Dr. Banamali Ghosh, M.B., D.P.H.

Assistant Research Worker—Dr. Phanindra Nath Bose, M.B., D.P.H., D.T.M.

Section of Maternity and Child Welfare—

Professor—

(Vacant up to 14th February 1939.)

Dr. L. S. Ghosh, M.B., Ch.B., W.M.S. (from 15th February 1939).

Assistant Professor—Dr. (Mrs.) Muktha Sen, M.B.B.S., D.M.C.W.

Section of Sanitary Engineering—

Professor—Mr. P. A. Midha, M.Sc., M.Eng., M.I.Struct.E.

Technical Assistant—

(Vacant from 1st January 1939 to 31st October 1939.)

Mr. G. Ghosh, B.E. (from 1st November 1939).

B.—Staff of the School of Tropical Medicine.

Section of Protozoology—

Professor—Dr. B. M. Das Gupta, L.M.P. (Dacca).

Assistant Professor—Dr. S. Sen, M.B., D.T.M. (Cal.), *(Officiating)*.

Section of Pharmacology—

Professor—Bt.-Col. R. N. Chopra, M.A., M.D., Sc.D. (Cantab.), F.R.C.P. (Lond.), C.I.E., K.H.P., I.M.S. (R.).

Assistant Professor—Dr. J. C. Gupta, M.B. (Cal.).

Section of Public Health Laboratory Practice—

Professor—Dr. A. K. Sen, B.Sc., M.B. (Cal.), D.P.H. (Eng.), M.R.C.P. (Edin.).

Assistant Professor of Public Health Laboratory Practice in Chemistry—Mr. Nani Lal Banerjee, M.Sc. (Cal.), A.I.C.

Assistant Professor of Public Health Laboratory Practice in Bacteriology—Dr. R. K. Banerjee, M.B., D.P.H., D.T.M. (Cal.).

Section of Bacteriology, Pathology and Helminthology—

Professor—Major C. L. Pasricha, M.A., M.B., B.chir. (Cantab.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), I.M.S.

Assistant Professor of Bacteriology—Dr. G. Panja, M.B. (Cal.), D.B. (Lond.).

Assistant Professor of Pathology—Dr. Kalipada Banerjee, M.B., D.T.M. (Cal.).

Section of Entomology—

Professor—

Dr. C. Strickland, M.A., M.D. (Cantab.), B.chir. (up to 25th May 1939).

Dr. D. N. Roy, M.D., D.T.M. (Cal.), (Officiating from 26th May 1939 to 31st December 1939).

Assistant Professor—Dr. D. N. Roy, M.D., D.T.M. (Cal.), (Officiating as Professor from 26th May 1939).

Section of Serology and Immunology—

Professor—Lt.-Col. S. D. S. Greval, B.Sc. (Punjab), M.D., Ch.B., D.P.H. (Liv.), I.M.S.

Assistant Professor—Captain S. N. Chandra, M.B. (Cal.).

Section of Chemistry and Physics—

Professor—Dr. Sudhamoy Ghosh, D.Sc., M.Sc., F.I.C.

Assistant Professor—Mr. Nihar Ranjan Chatterjee, M.Sc. (Cal.).

C.—Special Research Staff under the Indian Research Fund Association.

1. Cholera Statistical Enquiry—

Officer-in-Charge—Dr. R. B. Lal, M.B.B.S., D.P.H., D.T.M.&H., D.B., F.N.I.

Research Assistant—

Mr. K. C. Basak, B.A. (Cantab.), (up to 31st May 1939).

(Vacant from 1st June 1939.)

2. Epidemic Dropsy Inquiry—

Officer-in-Charge—Dr. R. B. Lal, M.B.B.S., D.P.H., D.T.M.&H., D.B., F.N.I.

Field Medical Officer—

Dr. S. C. Roy, M.B., D.P.H. (up to 30th March 1939).

Dr. S. R. Chatterjee, M.B.B.S., D.P.H., D.T.M. (from 31st March 1939).

Assistant Field Medical Officer—Dr. A. C. Das Gupta.

Chemist—Mr. S. P. Mukherjee, M.Sc.

3. Tuberculosis Inquiry—

Officer-in-Charge—Dr. A. C. Ukil, M.B. (Cal.), M.S.P.E. (Paris), F.S.M.F. (H.C.), F.N.I.

Research Assistant—Dr. S. R. Guha-Thakurta, B.Sc., M.B.

Industrial Tuberculosis Research Worker—Dr. P. K. Sen, M.B., M.D. (Berlin), Ph.D., T.D.D. (Wales).

Assistant Surgeon—Dr. Monimohan Bose, M.B.

4. Black Water Fever Inquiry—

Officer-in-Charge—Dr. K. V. Krishnan, M.B.B.S., D.B., M.R.C.P., D.Sc., F.N.I.

Organic and Physical Chemist—

Dr. M. Narsimha Rao, M.B.B.S. (up to 26th March 1939).

Mr. E. K. Narayana, M.A. (from 27th March 1939).

5. Researches into causes of Anæmia in Women—

Officer-in-Charge—Dr. L. E. Napier, M.R.C.P.

6. Tissue Culture Inquiry—

Officer-in-Charge—Dr. G. Sankaran, M.B.B.S.

Experimental Cytologist—Dr. S. S. Mukherjee, M.B.

REPORT BY DIRECTOR.

(Dr. John B. Grant, M.D., M.P.H.)

Historical summary.—Since the retirement of Lt.-Col. A. D. Stewart with effect from the 13th September 1935, Dr. R. B. Lal, Professor of Epidemiology and Vital Statistics, had been carrying on, in addition to his own departmental duties, the functions of the Director, which included the professorship of " Public Health Administration ". The concentration of the measure of responsibility involved in one officer must have thrown an inordinate burden, and the arrangement would only have resulted in sacrifice of effective working, and this together with the tentative nature of the arrangement could only have handicapped growth and development of the Institute.

At the request of the Government of India, the Rockefeller Foundation agreed to assign to the Institute, for acting as Director, the services of one of their Staff Members temporarily on a year-to-year basis subject to a maximum period of five years. The arrangement provided for the salary, etc., of the Staff Member, being borne by the budget of the International Health Division of the Rockefeller Foundation, the Government of India being responsible for the expenditure of the Institute and also providing the sum of Rs. 30,000 annually, in lieu of Director's salary, for utilisation on non-recurrent development expenditure of the Institute.

In pursuance of the arrangement outlined above, Dr. J. B. Grant took up the directorship of the Institute, including the professorship of " Public Health Administration " on the 3rd of July 1939. The Rockefeller Foundation made it possible for Dr. Grant to undertake a tour of Europe preparatory to the assignment of his services to the Institute. This provided him with an opportunity for familiarising himself again with progress in the various institutes in Europe. Being a new-comer to India, it was necessary for the new Director to familiarise himself not only with the teaching and organisation of the Institute but also with public health organisation and practices for which the All-India Institute provides public health instruction, and an all-India tour from July 31st to August 31st was undertaken before assuming the actual administration. Such a short and hurried tour could only provide a general knowledge of the public health and connected problems involved and the conditions prevailing in this demi-continent although it was sufficient to form the basis for the purpose of formulating plans for the reorganisation of teaching and research functions at the Institute.

The opportunity is taken of this report to review modern trends in the training of public health officers and to appraise briefly the degree that these trends are being followed locally.

A UNIVERSITY PUBLIC HEALTH INSTITUTE.

Scope.—Training in public health is the most emergent branch of medical education. Its origin in England consisted of individuals qualifying as health officers through their registering with a University in which they obtained public health amplification of knowledge of an under-graduate nature that was not provided through the M. B. syllabus. This was then supplemented by means of individual apprenticeship with a registered medical officer. Organised instruction in special institutes is a development since 1919. The continued uncomparability of international syllabi is the result of two factors:—

(*a*) The subjects, themselves, of instruction, are still largely in process of differentiation that must precede any degree of definition.

Hitherto, *Public Health* has been understood to be that branch of Medicine which deals with measures for the prevention of disease in the community as opposed to the individual. In other words, Public Health has been understood to be concerned with the prevention and control of infectious diseases, as small-pox; the inspection of markets in which articles of food are sold; hygiene, drainage, etc. Current thought in other countries attaches a much wider significance to the function of Public Health, which corresponds more closely to the literal meaning of the term, which has come to be regarded as implying the study and control of all factors which affect the health of the community. Medical measures alone are insufficient to ensure that the community has or attains a normal standard of health within the prevailing economic limits, which in reality has come to be regarded as the objective underlying the study of Public Health. The physical effect of occupation and of environment; the nutritive value of the food available; social customs; the educated consciousness of the community to attain a normal standard of health; economic factors; these are some of the factors which have to be studied in addition to the application of purely medical measures.

A study of all these factors requires a typical community of statistical significance numerically—both rural and urban—in which observation can be made and the results of the study of all questions connected with the health of Man in the community applied. This means the provision of an adequate rural and urban populations to be under the " Public Health " control of the teaching institution. This re-orientation and amplification of the concept of Public Health received its first significant synthesis at the hands of Sir George Newman in his now classical memorandum " The Outline of Preventive Medicine ". This synthesis has been brought up-to-date in Newman's " The Building of a Nation's Health ", 1939.

(*b*) Public Health is therefore organised community effort for medical protection and, as such, is Social Medicine, the utilisation of which must be different under varying social-economic conditions even although the principles derived chiefly from medical biology are universally similar. Consequently, it is essential that organisation for instruction and research must vary from country to country during the levelling-up process. Malaria must be afforded an importance in India that would be uncalled for in England. Health Insurance cannot be given the same prominence in China as in Germany.

Progress in differentiation has, however, reached a stage where a certain degree of definition is possible. Thus, the differentiated fields in herd public health already permit of parallelism with individual curative medicine where clinical and pre-clinical subjects are well-defined. Correspondingly in public health there are pre-field and field subjects, with the overlapping subjects of biometry and epidemiology corresponding to radiology and pathology in curative medicine. The differentiation is sufficient to permit of a tentative classification of subjects that provides a yardstick for measuring the extent of completeness of the All-India Institute. The subjects are:—

Pre-field—

1. Physiology as applied to public health—
   - (*a*) Chemistry.
   - (*b*) Nutrition.
   - (*c*) Physiological Hygiene as such.
2. Microbiology as applied to public health—
   - (*a*) Bacteriology.
   - (*b*) Immunology.
   - (*c*) Viruses.
   - (*d*) Protozoology.
   - (*e*) Helminthology.
   - (*f*) Entomology.

Overlapping—

3. Biometry.
4. Epidemiology—
   - (*a*) General.

Field—

- (*b*) Epidemic and endemic disease control—
  - (i) Specific disease control.
  - (ii) Tuberculosis.
  - (iii) Venereal Disease.
  - (iv) Malaria (India).

5. Public Health Engineering—
   (*a*) Sanitary—water, sewage, etc.
   (*b*) Housing.
   (*c*) Industrial—ventilation, lighting, etc.
   (*d*) Rural sanitation and malaria engineering—particularly in India.
6. Maternity and Child Health.
7. School Health.
8. Industrial Health.
9. Public Health Administration—miscellany and undifferentiated—
   (*a*) General Administration including national and international.
   (*b*) Port Health Administration.
   (*c*) Foods and Drugs.
   (*d*) Mental Hygiene.
   (*e*) Eugenics.
   (*f*) Public Health Nursing.
   (*g*) ETC.

Sectional policy should derive from general Institute policy. The final aim of the Institute is the development of, and training in, Methodology of community administration for medical protection. The pre-field sections of an adequately organised Institute direct research towards providing missing links in basic knowledge for community application. The field sections, on the other hand, should develop the methodology of utilisation. The overlapping sections of Epidemiology and Biometry, in addition to their specific functions, are also service sections for both pre-field and field sections to assist in planning research and in assessing the results obtained.

Training.—The function of investigation and instruction in public health is the development of the most efficient and practicable METHODS of scientific medical protection through organised community effort and the provision of opportunity for students to *train themselves* in the principles and application of these principles and methods. Both the investigative and the training functions demand the provision of controlled community areas to permit exemplification of methods of a size sufficient to provide quality and quantitative facilities for students' self-participation. The principles determining the controlled community fields in public health correspond exactly to those governing the provision of a teaching hospital to a medical college presenting investigative facilities and quality and quantity standards for students' self-participation and instruction.

An ancillary, although not the less important, function of an Institute during this period of evolution of medical education and community provision of social welfare should be to stimulate satisfactory undergraduate instruction in public health and satisfactory permeation of instruction in curative medicine with preventive practice. An

institute's chief contribution in this respect is to train competent medical college teachers of public health and preventive medicine. This implies that an Institute should itself be provided with experiment and demonstration facilities for the teaching of undergraduates in public health and preventive medicine during the period before satisfactory standards are attained. Eventually, of course, separate institutes of hygiene will merge and become integrated with their contiguous medical colleges to undertake the latter's educational and research functions in public health subjects.

Research.—The guiding principle of investigation has been defined above as the development of the most efficient and practicable methods of scientific medical protection through organised community effort. The absence of controlled community fields places the Institute under the same disabilities as would be faced by a department of clinical medicine in undertaking research in the absence of a teaching hospital. For, while the foregoing principle includes extension of the boundaries of knowledge in specific directions for which purpose planned research (basic and applied) in various academic subjects must constantly be carried out, any investigation is towards the ultimate goal of community utilization that depends upon development of practicable methodology. This corresponds in principle to individual clinical medicine's development of scientific methods of diagnosis and therapy but directed towards individuals. In the interim of providing controlled fields, investigations can and are carried on and thereby important results of general application can and have been achieved; but, little progress has been made in developing methods of utilization of the available knowledge. The result has been that it has not been possible for the Institute to discharge its chief function of making contribution towards the demonstration of the *utilisation* of scientific knowledge in the advancement of community health.

PROBLEMS OF THE ALL-INDIA INSTITUTE.

1. Organisation.

The foregoing definition of the primary function and scope of an Institute of Hygiene and Public Health permits measure of the extent of fulfilment on the part of the All-India Institute.

Inaugurated in 1932, the Institute was provided with only the following four subjects of teaching and research which were responsible for giving the students the full course prescribed in the D. P. H. curriculum of the Calcutta University:—

1. Public Health Administration.
2. Vital Statistics and Epidemiology.
3. Malariology and Rural Hygiene.
4. Biochemistry and Nutrition.

Instruction in "Sanitary Engineering" was included within the scope of "Public Health Administration". The result of this limited arrangement had been adversely reflected in the scope and the teaching not only of the important field covered by "Public Health Administration" as such but also of the equally important courses and practices included in the section of Sanitary Engineering. The latter section was, however, inaugurated in 1938, but the resultant reorganisation was not completed pending the appointment of a permanent Director.

The functions of the section of Maternity and Child Welfare were discharged through collaboration with the Countess of Dufferin's Fund until March 1937 when the Maternity and Child Welfare section was added to this Institute.

But even with the provision of the additional two sections, the organisation of the Institute is lacking in separate sections of either "Physiological Hygiene" or "Industrial Health".

The existence of the School of Tropical Medicine at the time of the establishment of the Institute led to the expectation that the collaboration between the two institutions would provide the teaching of the microbiological aspects of part I without separate sections in the Institute. Results have proved these arrangements to be unsatisfactory in the absence of provision of additional staff to assure the Institute with two necessities: a part I course separate from the D.T.M., and personnel in these fields available for research in their public health aspects. The result of this incomplete collaboration has been that, in addition to obsolete features in the syllabus, the teaching in these subjects has been suited more to the requirements of the general medical rather than the public health student, greater emphasis being laid on the clinical than on the preventive aspect. Also, the necessity of conforming to the six-months' D.T.M. time-table reacted to the disadvantage of part II having to be presented within an inadequate period. Further, this inadequate collaborative arrangement for teaching resulted in the Institute being deprived entirely of personnel in these subjects to undertake research in its public health aspects.

The lack in availability and organisation of field facilities is dealt with under curriculum below:

2. Curriculum.

D. P. H.—The syllabus as a whole needed revision, the two-fold objective being to keep abreast of modern trends in the training of public health personnel and to meet the special requirements of this country. Advancement in knowledge has differentiated certain subjects like Nutrition and Physiological Hygiene that are increasingly proving to be of importance to public health. These subjects were inadequately presented. Practical training under the old individual apprenticeship training was in many respects better pedagogically than the present practice provided in the regimented classes of the 'institute' period because of the totally inadequate facilities made available for practice-instruction of groups of students. The absence locally of adequate urban and rural controlled community fields for research and for self-participative instruction has been the major deficiency. Practical training has been poor in both quantity and quality, so much so that in such important subjects as School Health and Venereal Diseases Control it has been entirely lacking. Nor is trained personnel available for the "fields". Public Health Nursing is also a major deficiency in this respect.

With regard to the special needs of this country, it is noticed that while public health administrative practices have not yet been stabilised in the different administrative areas, there are certain common features applicable to the whole of the country. These have an important bearing on the previous part I syllabus. A major part of the Health Officer's duties consists of epidemiological investigation and control of disease. There is little or no time available to him, nor does he possess the facilities for detailed bacteriological, chemical and analytical work in the laboratory, for which he has to and should depend upon laboratory assistance of specialised departments. His chief duties mainly consist of application of epidemiological principles, based upon interpretation of laboratory reports, and to apply administrative control measures. This indicated clearly certain lines for revision of part I.

Another factor that has to be borne in mind is that, unlike England and other advanced countries, the fresh graduate from this Institute has to assume independent responsibilities for the administration of a district or municipal area, and has no opportunity of becoming acquainted with routine practical work in the position of an assistant. 'Practical' should be specifically designed to meet this demand.

PROGRESS.

A curriculum for part I (pre-field) subjects of the D.P.H. course has been drawn up in the light of the above considerations and independently of the course for the D.T.M. Effect has been given to the revised syllabus during the current session pending Government orders. The revised syllabus will need further modification in the light of experience gained and additional staff becoming available.

Proposals have been submitted for additional staff in order to provide for (*a*) separate teaching of D. P. H. from the D. T. M. students and (*b*) supervised community field practice and tutorial discussion of the problems involved.

Proposals have also been submitted for the establishment of controlled community fields, both rural and urban.

Pending the provision of adequate " field " facilities, it has not been possible to undertake any satisfactory revision of the syllabus for part II of the D. P. H. course. It is hoped, however, to undertake this next year. The present syllabus for this part is, however, so broadly defined that it has been possible to introduce certain changes in order to make it as effective as possible in the light of the limited facilities available. Also, the separated part I from the D.T.M. has permitted freedom in planning the D.P.H. time-table and reduced the previous part I period from six to three and a half months, thus making the necessary additional time available for part II.

It is significant that conclusions contained in the foregoing paragraphs in respect of the precise functions of the Institute and of the defects and deficiencies in the existing syllabus, and organisation are generally in agreement with the suggestions made in the Annual reports for the last five years and other documents and this should give added weight to the recommendations embodied in this report.

Maternity and Child Health.

The general remarks regarding the D. P. H. course are applicable also to the syllabus for the Diploma in Maternity and Child Welfare. Any additional comment is sufficiently implied to be unnecessary. A revised syllabus to remove the existing defects within the limitation of available facilities, particularly " field ", is in process of approval.

GENERAL.

For the academic session ending 14th September, teaching in Public Health Administration was carried on by Dr. R. B. Lal, Dr. J. B. Grant's report as Professor of the section will form part of the Annual Report for 1940. It must be pointed out, however, that in the writer's opinion a report of a section of Public Health Administration must obviously be of little significance in the absence of any public health to administer. A parallel would be found were a professor of clinical medicine unprovided with wards or a professor of physiology without laboratory facilities. The positive aspect of the situation is that the teaching efficiency of personnel of such a section in the absence of controlled field facilities decreases proportionately to the lapse of time since the individual's last period of field experience. The main routine interest of the section of public health administration should be the administration of its own community fields. To report in the absence of such administrative practice upon this or that substitute interest is so insignificant as to be totally inadequate from any academic standpoint, particularly of presumed university standards.

Teaching.—(i) The following table shows the number of Diplomas obtained during the year 1939:—

D. P. H. (University of Calcutta)—Part I	26
D. P. H. (,, ,,)—Part II	19
D. P. H. & Hy. (Faculty of Tropical Medicine and Hygiene, Bengal)—Part I	3
D. P. H. & Hy. (Faculty of Tropical Medicine and Hygiene, Bengal)—Part II	2
D. M. C. W. (Faculty of Tropical Medicine and Hygiene, Bengal)—Part I	1
D. M. C. W. (Faculty of Tropical Medicine and Hygiene, Bengal)—Part II	...

(ii) For the academic session commencing 30th October 1939, 29 D. P. H., 2 D. P. H. & Hy., and 1 D. M. C. W. students have been admitted. In view of the fact that the full time of the Staff would be occupied on account of the additional burden involved as a result of separate teaching of the part I course from the D. T. M. course, no students for the Special Courses usually provided by this Institute were admitted this year, pending the appointment of necessary additional staff.

Alumni.—In Appendix I statistics have been furnished relating to the students admitted since 1932-33, and an analysis has also been provided showing the manner in which alumni from this Institute are being employed. Approximately less than two-thirds are employed in public health departments. The D. P. H. training should be one of the first educational fields to demonstrate the greater demand for local qualifications in the light of local variabilities in administrative practices. This recognition will be accorded shortly after the students are

given adequate practice locally under Indian community conditions. Recent indications are that with the growth of interest in social welfare services, there will be a rapidly increasing demand for efficiently trained public health personnel.

Three of the provinces have facilities for offering training of the D. P. H. standard or its equivalent. The implications of this are obvious in relation to any institution designated " all-India ". The trend for provincial training of rank and file must and should increase and, correspondingly, an All-India Institute should possess facilities commensurate with its national position to train particularly for leadership.

Expenditure.—The following table shows the expenditure of the Institute since 1934-35.

Details of Budget Heads.	1934-35. Actual.	1935-36. Actual.	1936-37. Actual.	1937-38. Actual.	1938-39. Actual.	1939-40. Budget.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Pay of Officers . .	66,886	64,804	61,434	67,601	73,944	90,000
Pay of Establishment .	15,586	20,377	24,258	30,801	31,520	39,200
Other Charges :— (a) House-rent and other allowances including travelling allowances.	22,342	24,702	23,290	26,304	16,617	18,700
(b) Laboratory Contingencies.	22,747	29,459	28,877	33,139	24,188	39,000
(c) Other Contingencies.	25,826	27,503	25,127	27,385	25,323	29,800
Establishment charges paid to other Government Departments.	..	..	..	..	..	8,400
Lump sum provision for the development of the Institute.	..	..	..	..	..	30,000
TOTAL .	1,53,387	1,66,845	1,62,986	1,85,230	1,71,592	2,55,100

Capital.	Rs.
Land Acquisition	7,53,429
Building, etc.	8,44,620
Equipment	1,89,996
	17,88,045

Museum.—The total space devoted for charts and diagrams is approximately 1,814 sq. ft. and the floor space for models and specimens is 3,071 sq. ft. with about 1,000 sq. ft. on removable stands for posters and charts. Constant effort is made to keep this museum as an up-to-date one as far as finance permits.

The Museum continues to be visited by distinguished physicians and outstanding men of science from many of whom useful suggestions are received. Among the various groups of visitors are the students from the medical colleges and schools in Bengal, Tuberculosis course students and Sir John Anderson Health School students.

The exhibits are supplemented by models and charts. The total number of charts is 363 in addition to which there are 200 charts and posters distributed in the departments for reference and demonstration. There are about 200 models and 300 slides exhibited in all.

The publicity section of the Calcutta Corporation has been permitted to copy all the interesting and educative charts specially those relating to Nutrition which are proving useful for their propaganda.

The usefulness and necessity of the museum is increasing. The remodelling of the Institute will require additions and the appointment of staff exclusively for the museum will be necessary.

Library.—Ever since its inception the Institute has been building up a library of books and journals and literature relating particularly to public health and allied subjects. During the year under review, 171 books, 246 reports and 174 volumes of journals were added to the library, bringing the total to 6,552 at the end of 1939. In that year, 40 books, 189 copies of reports and 69 volumes of journals were received free or in exchange of the Institute publications and are gratefully acknowledged.

A system of reserved shelves, hitherto lacking, for referred reading has been introduced for the use of students. Library hours have been extended to meet the convenience of students.

Publications.—Appendix II provides a list of papers published by this Institute.

Distinguished Visitors.—Professor Robert J. Legge of the University of California paid a visit to the Institute early in 1939. Major-General E. W. C. Bradfield, C.I.E., O.B.E., K.H.S., I.M.S., then Director-General, Indian Medical Service, and Lt.-Col. E. Cotter, I.M.S., Public Health Commissioner with the Government of India, visited the Institute in July 1939.

In December 1939, the Honourable Kunwar Sir Jagdish Prasad, K.C.S.I., C.I.E., O.B.E., Member of the Executive Council of the Governor-General, in charge of the Department of Education, Health and Lands, honoured the Institute by paying a visit.

Acknowledgments.—It affords me great pleasure to express my personal appreciation of the whole-hearted co-operation and assistance received from the professorial and other staff of the Institute, both superior and subordinate.

Grateful thanks are expressed to Bt.-Col. R. N. Chopra, C.I.E., K.H.P., I.M.S. (Retd.), Director of the School of Tropical Medicine, for the fullest possible co-operation, help and advice that has been continuously available from him personally. Thanks are expressed also to the members of the Staff of the School of Tropical Medicine for their co-operation and help, especially for their collaboration in providing a part I course, separate from the D. T. M. course.

REPORT OF THE PROFESSOR OF VITAL STATISTICS AND EPIDEMIOLOGY.

(Dr. R. B. Lal, M.B.B.S., D.P.H., D.T.M. & H., D.B., F.N.I.)

Staff.—Considerable changes in the staff took place during the year. The writer continued to officiate as Director and Professor of Public Health Administration in addition to his own duties till the end of June. Subsequently considerable time and attention was devoted to schemes of re-organisation of the Institute and revision of the syllabus for D. P. H. and D. M. C. W. courses. The post of Mathematical Assistant remained vacant practically throughout the year. Mr. S. Swaroop continued to act as Assistant Professor till the 4th May when he was relieved by Dr. P. V. Sukhatme, Ph.D., D.Sc., who joined the Institute for the first time on that date. On Mr. K. C. Basak's resignation on the 31st May the post of Research Assistant in the Cholera Statistical Inquiry was abolished.

Teaching.—Besides the usual course of lectures and of practical work given to the D. P. H., D. P. H. & Hy., and D. M. C. W. students in Statistics and in General and Special Epidemiology, the course of instruction in General Hygiene, Public Health Administration and Sanitary Law for these students as also courses in Tropical Hygiene for the students attending D. T. M. and L. T. M. classes at the Calcutta School of Tropical Medicine were conducted.

Dr. S. Raghavender Rao continued his work on the Epidemiology of Plague under the supervision and guidance of the Professor and submitted his thesis for D.Sc., in Public Health to the Calcutta University.

Research.

(A) Epidemic Dropsy Inquiry.

(a) *Field Investigation.*

1. *Estimation of the value of differential tests.*—In last year's report 2 physical and 2 chemical tests to differentiate between samples of mustard oil associated with epidemic dropsy and those not so associated were described. Further work was carried out to assess the value of those tests. The final results are shown in table I. Altogether 321 samples of oil with epidemiological histories have been collected by field staff and health officials; of these 245 samples are accompanied by satisfactory epidemic history.

TABLE I.

Test.		Epidemiological evidence regarding toxicity or otherwise of the sample.			
		Strong.		Suggestive.	
		Toxic.	Non-toxic.	Toxic.	Non-toxic.
Nitric Acid	Positive	22	2	38	58
	Negative	2	21	16	86
Cupric Acetate	Positive	22	0	37	50
	Negative	2	23	17	94
Fluorescence	Positive	23	11	49	98
	Negative	1	12	5	46

2. The incidence of Argemone mexicana seeds in stocks of mustard seeds.—Reference to an investigation into the extent of the occurrence of *Argemone mexicana* seeds in stocks of mustard seeds in oil mills was made in last year's report. Further work on these lines was carried out. The results obtained in a total of 396 samples are summarised in Table II.

TABLE II.

Percentage of Argemone seeds.	*Nil*	—1	—2	—5	—10	Above 10
Number of samples	179	150	24	27	6	10

Further analysis showed that it was only in certain varieties of mustard seeds that the argemone seeds were found in appreciable quantities. These varieties are known as *Torai* (*Brassica napus*) and *Rai* (*Brassica juncea*). The reason is obvious namely that these two varieties of mustard seeds are light black in colour resembling that of argemone seeds and the size of the seeds is also very much the same.

3. *Investigation to note the effects of consumption of mustard oil pressed from mustard seeds containing an appreciable quantity of seeds of* Argemone mexicana.—Daily examination of mustard seeds, waiting to be crushed in an oil mill, was made to estimate the percentage of *Argemone mexicana* seeds. A stock containing 9 per cent. *Argemone mexicana* seeds was discovered after a long wait. This supply of the seed was crushed in a clean crushing mill and the oil was stored in a clean tank after dilution with oil from other types of mustard seeds which was necessary for trade purposes. The quantitative test showed that the mixture contained only 1·75 per cent. *Argemone mexicana* oil. Similarly a supply of oil obtained from stock of mustard seeds free from *Argemone mexicana* seeds was stored in another clean tank. The two supplies were separately filled in tins bearing distinguishing marks

and were consigned to distant isolated communities in which there had been no outbreak of the disease for some time. A close watch was kept to note the distribution of the oil in different families which were kept under supervision to detect the occurrence of cases for over a month. No cases developed except in one well-to-do family which had consumed a full tin of the contaminated oil. The absence of cases amongst other families may be accounted for by the fact that the argemone oil content of this supply was very low being less than 2 per cent. as against 5 per cent. of Rangpur oil which had been successfully used in a human experiment. Moreover, the people being poor, they could only afford to use the oil in very small quantities and that too irregularly.

4. *Relation between the concentration of argemone oil in the mustard oil and the development of clinical symptoms.*—From the above observation as well as from our previous experience, it is evident that symptoms of the disease do not develop unless the oil is of sufficiently high potency and a sufficient amount of the toxic substance has been consumed. As may be seen from Table II small quantities of *Argemone mexicana* seeds are found in a large percentage of stocks of mustard seeds in the oil mills. The question, therefore, arises whether in view of the fact that the habits of the people vary considerably with regard to the amount and regularity with which they consume mustard oil and also with regard to the constancy of the source it would be justifiable to discard all these supplies. The quantitative aspect of the problem cannot be, therefore, ignored and some legal standards have to be found for administrative convenience. For this purpose a quantitative test of the amount of reacting substance in the oil was developed. This consisted of a colorimetric estimation of the nitric acid reaction as tested by Pulfrich's photometer under standard conditions. In order to correlate the values obtained by the test with the quantities of oil consumed and the clinical reactions an investigation was instituted in certain hostels in Calcutta. The work was carried out throughout the year but none of the samples of oil examined gave appreciable reaction nor any signs of the disease were observed in the community under supervision. These and other studies lead to the conclusion that less than 1 per cent. argemone oil in mustard oil fails to produce symptoms of the disease under the conditions prevailing in Bengal. This, however, does not imply that argemone oil taken in sub-clinical doses over a prolonged period may not cause damage to health or lower resistance to other diseases. Taking everything into consideration, it should be safe to say that sale of mustard oil containing $\frac{1}{2}$ per cent. or more of argemone oil should not be permitted unless it is coloured to prevent its use for cooking purposes. Another point which has emerged from these studies is that the toxic substance acts on the human system irrespective of the type of food taken and dietetic deficiency does not enter into the picture.

(b) *Laboratory investigations.*

1. *Development of the quantitative test.*—Reference has already been made to this test. The standard conditions worked out for the determination of extinction coefficient were as follows:—

(i) Wave length—4,600 A. U.

(ii) Period for completion of the test 20 minutes.

(iii) Thickness of the cell 0·5 to 1 centimeter according to the concentration of the reacting substance.

(iv) Dilution ranging from 1 in 1 to 1 in 4 according to concentration.

Gauging curves correlating the coefficient of extinction with the quantity of reacting substance and roughly with the concentration of *Argemone mexicana* oil have been worked out. Thus the amount of this contamination in mustard oil can be read off directly. The gauging curve denoting the extinction coefficient against the quantity of the reacting substance present in any sample of oil can be expressed by a simple linear equation, namely, $x - 2y = 0$, where

x = mgm. of the reacting substance present per 100 c.c. oil.

y = value of extinction coefficient at 4,600 A. U.

Three papers on the Epidemiology of Epidemic Dropsy embodying the observations mentioned in the foregoing paragraphs have been prepared for publication.

2. *Effect of light and air on the concentration of the reacting substance.*—It was observed that the reactivity of toxic mustard oils and of mixtures of *Argemone mexicana* oil in pure mustard oil was reduced on exposure to light particularly in the presence of air. It was further noticed that while exposure to light in the absence of air caused reduction in the values of extinction coefficient of mixtures of argemone oil in pure mustard oil little or no reduction took place in pure argemone oil under these circumstances. The reaction causing reduction in extinction coefficient did not take place in the absence of light. Both ultra-violet and visible lights were effective. Direct sunlight effected the change rapidly while diffused light took long time to do so.

TABLE III.

	Control reading.	Exposed to direct sunlight for 5 hours in contact with air.	Exposed to direct light for 5 hours in the absence of air.	Exposed to diffused light for 3 months in contact with air.	Exposed to diffused light for 3 months in the absence of air.	Kept in dark for 3 months in contact with air.	Kept in dark for 3 months in the absence of air.
Pure mustard oil . .	0	0	0	0	0	0	0
Mixture of 5 per cent. argemone oil in pure mustard oil.	4·9	1·68	3·4	2·4	2·3	4·7	4·6
Pure argemone oil (diluted after treatment to form at 5 per cent. mixture with pure mustard oil).	4·9	2·9	5·0	2·8	4·8	4·76	4·7

3. In last year's report reference was made to an organic crystalline compound obtained from *Argemone mexicana* oil and from the mustard oil associated with the disease. Variable results of melting point and of chemical constitution of this substance indicated that the substance had not been isolated in pure form. Using another technique it was found possible to obtain pure white rhomboidal crystals giving a constant melting point of 189° C. and a density of 1·4 at 30° C. This substance satisfied all the differential tests. The crystals left no ash on incineration. They were sparingly soluble in absolute alcohol but insoluble in strong or dilute alkalies. They dissolved in dilute hydrochloric acid and in most organic solvents. Microchemical analysis suggested an empirical formula of C_{19} H_{15} O_4 N.

The substance is probably alkaloidal in nature as shown by Mayer's and other tests for alkaloids. The properties of the crystals do not correspond with those of berberine or protopine, the two alkaloids which have been described in *Argemone mexicana* plant. It has been found possible to almost free the *Argemone mexicana* oil of the reacting substance by extraction with dilute hydrochloric acid. Further work on the chemical nature of the crystalline substance and its relation to the toxic substance responsible for epidemic dropsy syndrome are under investigation.

4. *Biological tests.*—A biological test must necessarily be evolved for elucidation of the nature of the toxic substance. Clinical test on human subject is not easily available. Reference was made to the skin test and tests on laboratory animals in last year's report. Further feeding experiments on cats were carried out. In these tests the problem of correspondence or otherwise of the reacting substance and the toxic substance contents of oil was also included for study.

Cats were selected for the feeding experiments because in previous work these animals had shown evidence of susceptibility to toxic oil in the way of loss of weight and fatal termination, although no symptoms of the disease, as manifested in man, had been observed.

Animals were divided into 5 groups as follows:—

(*a*) Fed on 5 per cent. argemone oil in pure mustard oil.

(*b*) Fed on 5 per cent. argemone oil in mustard oil, the argemone oil being previously altered by exposure to sunlight for a long time so as to reduce reactivity to about one-tenth of the original.

(*c*) Fed on mustard oil containing 5 per cent. argemone oil from which HCl soluble substance had been removed; final mixture contained only about one-fiftieth of the reacting substance of argemone oil.

(*d*) Fed on pure mustard oil containing the white crystalline substance obtained from argemone oil, the mixture giving pulfrich reading equivalent to 5 per cent. argemone oil.

(*e*) Control group—fed on pure mustard oil.

Animals in group (a) suffered definite damage to their health. They suffered from anæmia, emaciation and loss in weight. The animals in other groups gained considerable weight and showed no evidence of deterioration in health. Skin snips were taken from the animals at

fortnightly intervals. Group I cats showed large number of capillaries in the skin. The capillaries, however, did not consistently show any dilatation as is commonly found in affected human skin. Cats in other groups did not show such changes but there was dilatation of capillaries in certain organs. If excessive number of skin capillaries is taken as a criterion of specific toxic effect, the above results would indicate that the organic crystals were not toxic and that both the reacting and the toxic substances were removed by dilute HCl and destroyed by the action of light on the oil.

(B) Cholera Carrier and Epidemiological Inquiry.

(a) *Bacteriological Section.*—Work under this inquiry was carried out during the first three months only, thereafter the inquiry was closed down.

(i) *Serological variations in cholera vibrios during convalescence.*

One of the moot points in the bacteriology of cholera is the question of variations in the vibrio. Attempt was made to see whether the agglutinable vibrio changed in its serological reactions in the gut of man. A special room was reserved for receiving typical cholera patients from whose stools none but agglutinable vibrios had been isolated on the first examination both by Wilson and Blair's medium and peptone water techniques, a large number of colonies being examined in each case. All possible measures were taken to exclude the introduction of extraneous vibrios into this room from outside sources. Three such cases were admitted and daily examinations of their stools using both techniques were carried out. In all these cases non-agglutinable vibrios either alone or together with agglutinable vibrios were isolated from the stools, although on certain days vibrios of the latter type only were recovered. These findings are suggestive of serological variation occurring in the gut of man. However, in view of the fact that the possibility of a mixed infection present originally but escaping notice at the first few examinations and becoming demonstrable later on, cannot be excluded with absolute certainty. Final conclusions may be reserved until such time as observations on a large number of cases are available. Further work had to be suspended for want of suitable clinical material. However, the problem is of great academic and practical importance and needs to be pursued further.

(ii) *Fly passage to induce changes in vibrios.*

A single cell culture of a non-agglutinable vibrio strain which belonged to Linton's Group III and which had been obtained from a water source that had previously yielded agglutinable vibrio was passaged through flies in the manner already described by us (Lal, Ghosal and Mukherji, Indian Journal of Medical Research No. 26, January 1939, pp. 597-609). The biochemical and metabolic reactions were similar to those obtained on previous occasions. A tendency towards specific agglutinability was also noticed.

(iii) *Relative value of modified Wilson and Blair's medium and peptone water medium in the isolation of agglutinable cholera vibrio and other vibrios.*

Results of stool and water examinations carried out on material obtained from certain parts of Calcutta and some rural areas were

reported last year. Similar work on 28 cases admitted in cholera wards of the Campbell Hospital conducted during the present year confirmed the previous findings. From the stool of the three clinically diagnosed cases of cholera first examinations yielded agglutinable vibrios with both the media. In subsequent examinations Wilson and Blair's medium proved more efficient than peptone water medium both in encouraging the growth of agglutinable vibrios and in suppressing other vibrios. Similar results were obtained in other cases also. An interesting observation in this connection is that in as many as 10 out of 23 cases clinically declared non-cholera by experienced physicians agglutinable vibrios were isolated on a single examination by Wilson and Blair's technique. Even with peptone water 6 cases yielded such vibrios. Examination of water from certain tanks which had been subjected to at least a monthly examination since June 1938 was continued. Here again evidence of suppression of non-agglutinable vibrios in Wilson and Blair's medium was observed. Agglutinable vibrios were recovered from five tanks only and this appeared at the time when cases of cholera in that quarter were occurring.

(iv) *Chemical examination of water in connection with the question of persistence of infection.*

This work was started in June last year and was continued till the close of the enquiry. Progressive increase in the salt content, total solids and organic matter was found in the samples of water examined during this period. Available data are not sufficient to determine the significance of these observations in relation to persistence of infection and other epidemiological considerations.

(b) *Statistical Inquiry.*

Analysis of the Field Data.

Analysis of a large amount of data which had been accumulated in the course of Cholera Carrier and Epidemiological Inquiry in Diamond Harbour area was commenced. After completing the transfer of data to punch cards which occupied a considerable time of the enquiry, an investigation into the general health conditions of the population was carried out as this was considered a necessary preliminary to cholera inquiry proper. The population was divided on a simple basis into four classes, *viz.*, (i) Well, *i.e.*, those who had no complaints at the time and looked healthy, (ii) Indifferent health, *i.e.*, those who though not actually sick did not feel quite fit and did not look active and bright, (iii) Actually sick at the time of visit and (iv) Suffering from chronic illnesses. Further analysis to study the relation of these groups with age, economic status and occupation was carried out. In addition the rôle of gastro-intestinal disturbances in regard to health conditions was worked out.

Cholera Forecast.—In the report of work done during last year it was mentioned that the method elaborated for forecasting cholera in Calcutta was applied to homogeneous districts. The method was found suitable in 10 out of 19 districts. The results of this work are presented below in the form of regression equations, where y denotes the expected

number of total deaths from cholera in any year and x denotes the cholera mortality for 45-52 weeks of the preceding year.

Homogeneous district No.	
2	$y = 175{\cdot}18 + 2{\cdot}32x$
4	$y = 16{,}749{\cdot}74 + 3{\cdot}06x$
8	$y = 1{,}293{\cdot}08 + 4{\cdot}28x$
9	$y = 8{,}847{\cdot}26 + 9{\cdot}81x$
11	$y = 336{\cdot}07 + 8{\cdot}13x$
13	$y = 1{,}562{\cdot}99 + 4{\cdot}18x$
14	$y = 1{,}973{\cdot}19 + 2{\cdot}51x$
15	$y = 25{\cdot}98 + 3{\cdot}09x$
17	$y = 3{,}101{\cdot}79 + 6{\cdot}07x$
19	$y = 26{\cdot}47 + 3{\cdot}68x$

(C) Public Health Survey.

Stouman and Falk and more recently a committee of the League of Nations Health Organisation instituted in connection with the European Rural Health Conference had drawn up a list of Health Indices which they recommended for adoption by the National and Local Health Authorities so that information required for the planning of the most efficient and the most economical public health policy may be made available on a uniform basis and thus facilitate comparisons. The routine official statistics available in India are admittedly inadequate and sadly unreliable and the need for collection of proper data is beyond question. However, with the available resources it is hardly to be expected that health administrations in this country will be able to produce the Health Indices. Even if the necessary machinery could be put together it is doubtful whether these indices would be found suitable for Indian conditions or, what is more important, would adequately answer our requirements. An alternative method would be to conduct periodical surveys to obtain a view of cross-section of matters relating to health and thereafter follow only such leads as may be considered most important and most practicable. A scheme of public health survey was, therefore, projected. Two guiding principles were adopted in the preparation of schedules namely (*a*) well-defined objects for which the information collected was to be utilized must be constantly kept in view and (*b*) a system of marking for assessment of values must be adopted wherever possible. The scope of the proposed survey includes the use of the data to serve as (1) a yard-stick for measuring the state of public health. This would comprise of health indices, the extent and efficiency of performance of health service—both official and non-official, and the degree of appreciation and responsiveness of the population to communal health effort, (2) guide in organising public health activities on the basis of a knowledge of the socio-economic, physiographical and other factors involved and (3) indicator of the line along which special investigations have to be carried out.

The system of assessment is based on the same principles as are employed in academic examinations. They have been applied to public health assessment in the American appraisal forms for urban and rural areas. It is hoped that facilities for a practical trial of the scheme of survey will become available in the near future. When sufficient

experience has been gained it should be possible to devise a standard method of survey, which may be adopted by the public health authorities in this country.

An introductory paper on this subject is ready for publication.

(D) Fisher and Behrens' Test of Significance.

One of the important recent advances in statistical science consists in the solution put forward by Fisher and Behrens for the comparison of samples with possibly unequal variances. The solution has been obscured by some controversy but has been recently demonstrated by Fisher as the correct solution of the problem in the light of Sukhatme's work published in Sankhya (1938). Further work mainly consisting in the tabulation of one *per cent.* values and exploration of characteristics of the test in other regions of the distribution was continued during the year.

(E) Moments and Product-Moments of Moment-Statistical for Samples of the Finite and Infinite population.

Methods of practical evaluation of bi-partitional functions developed by Sukhatme in his paper in the Philosophical Transactions of the Royal Society of London Series A, No. 780, Vol. 237, 1938 were applied to obtain the total number of formulæ of degree no higher than 8 giving the moments and product moments of moment-statistics for the direct use of practical statisticians. The paper embodying the results has been communicated to the Indian Science Congress.

(F) Leprosy Survey.

A field investigation into the epidemiology of leprosy was organised in 1934 by the Bengal Branch of the British Empire Leprosy Relief Association in co-operation with this Department. Statistical analysis of the field data was taken in hand. Information contained in 10,011 general schedules and 495 case schedules was transferred to punch cards. Further work is in progress.

(G) Tuberculosis Investigation.

A schedule for recording clinical data in the various dispensaries organised by the Tuberculosis Association of Bengal was prepared in consultation with the Honorary Tuberculosis Medical Officers. Data borne on 20,000 cards were transferred on punch cards and partial analysis of a routine nature was carried out. More detailed analysis is in progress.

(H) Incidence of Salmonella Group of Organisms in rats.

Attention was drawn in the previous report to the prevalence of Salmonella group of organisms in rats of Calcutta and to the danger it involves. Further work has been carried out during the year on the same plan as described in that report.

Sixty more rats were examined which brought the total number examined to 364. Of these 49 or (13·7 per cent.) harboured Salmonella

organisms. Biochemical and serological examination showed that about 75 per cent. of the strains isolated were *Bact. typhimurium* and the rest were *Bact. enteritides.*

Salmonella Organisms in Sewage.—A recent investigation in England shows that sewage may contain these organisms and may cause infection by contaminating water. An investigation was carried out during the year to find out their incidence in sewage of Calcutta. Fifty samples of sewage were examined, of which 3 were positive for *Bact. typhi murium* and 2 for *Bact. enteritides.* This observation shows that these organisms though not so common in sewage as *Bact. typhosus* (previously shown by us), are by no means rare and contamination by sewage may play a part in the infection of human beings by Salmonella organisms.

(I) Services to other Sections.

As in previous years assistance was given to other sections of the Institute and of the Calcutta School of Tropical Medicine and the Physiological Department of Calcutta Medical College in connection with the analysis and interpretation of statistical data. Some of the investigations in which such assistance was given are briefly mentioned below.

Data giving classification by blood-groups O, A, B, and AB of 2,472 subjects of the Calcutta population, by communities, received from the Imperial Serologist, were statistically examined for heterogeneity among communities. This was achieved by the straightforward application of the x^2 test for contingency tables. The problem of testing for heterogeneity the proportions of gene frequencies in the various communities as deduced from Bernstein's hypothesis was, however, found to call for special methods of estimation and tests of significance. The analysis of the whole data together with the derivation of the statistical tests has been incorporated in a separate paper.

The time-series giving the monthly admissions, new and old, to the Filariasis out-patients Department of the School of Tropical Medicine during the period from 1929 to 1938 was statistically analysed for cyclical and seasonal influences. The results of analysis have been incorporated in a joint paper which is ready for publication.

Data giving mean-diameter of 500 red cells for each of 50 individuals, some of whom were suffering from microcytic anæmia and others from macrocytic anæmia were statistically examined to estimate their deviation from the standard curve for mean red-blood cell diameter for healthy Indian subjects previously worked out by Napier, Sankaran and Satya Swaroop. The work is still in progress.

An enquiry into the ætiology of anæmia of pregnancy was planned in co-operation with Dr. L. S. Ghosh, Professor of Maternity and Child Welfare and Dr. S. C. Mitra of Chittaranjan Seva Sadan. The investigation is in progress.

Acknowledgments.—I take this opportunity of recording my appreciation of the courtesy and co-operation received from my colleagues and assistants. I am grateful to Dr. J. B. Grant, Director of the Institute, for the consideration he has shown in meeting the needs of this Section.

REPORT OF THE PROFESSOR OF MALARIOLOGY AND RURAL HYGIENE.

Dr. K. V. Krishnan, M.B.B.S., M.R.C.P., D.B., D.Sc.

The work of the Section falls under two heads—Teaching and Research.

Teaching.—On account of the separation of Part I from the D.T.M. syllabus the staff of the Section had very considerable additional teaching to do in the year under review. As in previous years Part II lectures and demonstrations in malariology, Venereal diseases, tuberculosis and other communicable diseases were given to the D.P.H. and D.P.H. & Hy. students and a series of special lectures on the Bacteriology of Tuberculosis was delivered to the post-graduate students in Tuberculosis under the King George's (Anti-Tuberculosis) Fund. In addition to the above, the staff of the Section co-operated with the staff of the School of Tropical Medicine in giving instruction to the D.P.H. and D.P.H. & Hy. students in some of the subjects of Microbiology (Protozoology, Entomology and Helminthology) and completely took over from them the teaching of Bacteriology, Immunology and Filterable Viruses. Although this additional work had to be undertaken at short notice and threw a considerable amount of strain on the staff, it received their fullest co-operation and the revised course proved a complete success. Thanks are due to all the members of the Section for their valuable help but for which it would not have been possible to prove the greater usefulness of the revised course.

Research.

Treatment of Blackwater Fever.—Two more cases of this disease were treated successfully with a combination of Cortin, ascorbic acid and glucose-saline, thus bringing the total to 17 cases. Whatever may be the correct explanation for the high therapeutic value of this line of treatment, there appears to be no doubt that in our hands it has proved to be better than any other form of treatment so far known. The use of Cortin of high potency does reduce the mortality in Blackwater Fever considerably.

Hæmolytic agent in monkey hæmoglobinuria.—Attempts were made to isolate the hæmolytic agent causing hæmoglobinuria in monkeys infected with P. knowlesi. On the supposition (based on our previous findings) that the hæmolytic agent is probably of the nature of an unsaturated fatty acid, the veinous blood of hæmoglobinuric monkeys was removed and extracted with ether in separating funnels and the ethereal layer evaporated at low temperature to remove the ether and the extract preserved in an atmosphere of nitrogen in the refrigerator. For purposes of comparison ether extracts of blood of normal animals were also obtained. These extracts were then tested for their hæmolytic activity on washed normal monkey erythrocytes. Although the number of extracts so far studied is few, the results seem to lend some support to our idea that the hæmolysin is probably a fatty substance. The findings were as follows:

(i) The extracts from normal and hæmoglobinuric monkeys were both hæmolytic.

(ii) The hæmolytic titre of extracts from hæmoglobinuric monkeys was greater in most cases than that of normal monkeys.

(iii) On the addition of cholesterol to the extracts prior to testing their hæmolytic activity, it was found that the hæmolytic titre of extracts from hæmoglobinuric monkeys was markedly brought down while the titre of normal extracts remained unaltered.

These observations are particularly interesting as they provide some indirect support to our previous observation, that the causal agent of hæmolysis in blackwater fever is probably an unsaturated fatty acid produced in the liver and that it acts only when free cholesterol is low.

Preparation of Cortical Hormone.—With the demonstration of the therapeutic efficacy of cortin in blackwater fever, the necessity for a reliable preparation of this hormone for use in human cases, was felt. Commercial preparations were usually found to be untrustworthy and in cases of preparations of established reputation such as those of the Wilson Laboratories, United States of America, the cost was prohibitive and the supplies limited. Various methods of preparation of this hormone described in literature were therefore investigated and a modified technique for preparing potent extracts was elaborated. A brief summary of this work is given below.

The first point investigated was the method of collecting and preserving the adrenal glands. In this matter there seems to be no agreement among different workers. It is well known that the adrenal glands after removal undergo rapid autolysis and Grollmann observes that ill-preserved and autolysed glands yield extracts of poor potency. In Swingle and Pfiffner's method the glands are packed in ordinary ice and extracted within 24 hours of removal from the animal. Cartland and Kuizenga get their glands packed in dry ice. Grollmann finds that with glands frozen in liquid air; dry ice and ordinary ice the amounts of the hormone obtained are in the ratio of 500 : 100 : 10, respectively. In our experience also glands collected in ordinary ice did not yield good extracts due probably to the delay in cooling and the consequent autolysis. In freezing mixtures of ice and salt the glands took about 20 minutes to cool down to *plus* 10° C. In a tropical country like India it appears to be very necessary not only to remove the glands from the animal immediately after slaughter but also to freeze them straightaway after removal. Using liquid air (– 180° C.) after a preliminary cooling in a mixture of dry ice and acetone (– 80° C.) potent extracts were obtained.

The second point investigated was the method of removal of the proteins and phospholipoids from the extract. The fact that cortin is soluble in fat solvents in which proteins do not dissolve has enabled all workers to eliminate these most easily. The gland is directly extracted by a fat solvent which takes up the cortin along with the fat and adrenaline. Hartmann and Brownell employ ether for this purpose while Swingle and Pfiffner use alcohol, while others like Kendall, Kutz, Grollmann, Cartland and their co-workers employ acetone. In our investigation alcohol was found to be better than ether and acetone superior to alcohol. Acetone took up less of phospholipoids and gave weight for weight more potent extracts.

The third point investigated was the method of removal of fats from the extract. The cortical extract after acetone extraction contains large quantities of adrenaline and neutral fats and attempts to remove these considerably lower also the cortin content. Grollmann claims to have separated all the fat by freezing and filtering. This method was not found to be quite satisfactory. Swingle and Pfiffner separate the fat by repeated distribution of the extract between 70 per cent. alcohol and petrol-ether. The process is very slow and provides many chances for the complete loss or inactivation of the cortical principle. Cartland and Kuizenga claim that if an aqueous acetone extract of the gland is first evaporated to remove the acetone and then shaken with petrol-ether, the neutral fat alone is extracted. Our experiments show that although petrol-ether does not take up cortin from its pure aqueous solution, it does dissolve the hormone when it is mixed with fat. Therefore, by restricting the extent of the petrol-ether extraction it has been possible to minimise the loss of cortin. Cartland and Kuizenga have recently claimed that ethylene dichloride takes up from aqueous solutions cortin, but not adrenaline. This claim is attractive; but in view of the fact that no evidence is available to show that this method has received universal acceptance, their claim had to be verified. On determining the partition co-efficient of adrenaline between water at pH 5·0 and this solvent, it was found that values were of the order of 500 : 1. This procedure was therefore adopted and it gave excellent results. The technique of preparation as modified by us is under publication.

The extracts made by the modified technique have been tested on bilaterally-adrenalectomised mice and have been shown to be as potent as the extract obtained from the Wilson Laboratories, Chicago.

Attention was also paid to the elaboration of a technique for the spectrophotometric method of assaying cortin, but the results were inconclusive.

Crystals were obtained from the potent concentrates of the cortical extract prepared. Although obtaining crystalline fractions out of cortical extracts is nothing new, it indicates the high grade of purity reached by our method of preparation.

Malaria Problem at Singur.—In connection with the field training of the D.P.H. and D.P.H. & Hy. students at the Model Health Unit at Singur, a preliminary investigation of the malaria problem at Singur was made and the findings embodied in a report. The conclusion reached were that the problem at Singur was more or less similar to the problem in the decadent areas of Bengal where dead rivers and irrigation canals and embankments play an important part.

Malaria at Abujhati.—The observations made and the data collected during the last three years with regard to the anopheles carrier of malaria in the villages around our Field Centre at Abujhati, were analysed and the following conclusions arrived at:—

(1) There are 12 species of anophelines in the area, *e.g.*, *A. annularis* (Vander Wulp), *A. pallidus* (Theobald), *A. philippinensis* (Ludlow), *A. ramsayi* (Covell), *A. varuna* (Iyengar), *A. aconitus* (Donitz), *A. hyrcanus* var *nigerrimus* (Giles), *A. barbirostris* (Vander Wulp), *A. vagus*

(Donitz), *A. subpictus* (Grassi), *A. tesselatus* (Theobald) and *A. culicifacies* (Giles). Of these *A. philippinensis* is the only species which was found to be infected in nature. Of over 5,148 anopheles dissected, 1,053 were *A. philippinensis* of which 89 were found to have gland infection giving a sporozoite rate of 7·5 per cent.

(2) A study of the habits of *A. philippinensis* revealed that this species is chiefly a domestic species living in closer association with man than with domestic animals. In 1936 out of 845 cow-sheds searched for adults only 14 yielded positive results, while, out of 160 dwelling houses 36 yielded positive results. This gives a percentage of 22·5 in houses as against 1·6 in the cow-sheds. Percentage of houses showing *A. philippinensis* varied from month to month, and also from year to year. During the years 1937-1939 the highest percentage was 90, and the lowest 34. The number of *A. philippinensis* caught per house varied from 0·08 to 3·4. As the species is purely domestic the use of insecticide sprays for controlling them in the dwelling houses is worth considering.

(3) During the investigation, samples of blood from the stomachs of *A. philippinensis* caught, were obtained for precipitin test. Arrangements have now been made to send these to the Malaria Institute of India for study.

(4) A study of the breeding places and breeding habits of *A. philippinensis* revealed (*a*) that they prefer tanks, dobas, railway burrowpits, lowlands and canals, in the order shown. Tanks and dobas were the most important. Of the 93 tanks under constant observation 19 per cent. were found breeding this species in 1937, 54 per cent. in 1938 and 25 per cent. in 1939. Of the 66 dobas under observation 4·5 per cent. were found to breed larvæ of the species in 1937, 25 per cent. in 1938 and 16 per cent. in 1939. A few railway burrowpits were found to breed larvæ late in the malarial season. The lowlands and canals showed larvæ occasionally. Although from 1936 to 1939 twelve paddy fields were kept under constant observation, on no occasion was *A. philippinensis* found to breed in any of them. Even in the year 1938 when there was an exacerbation of malaria, the paddy fields were not found to breed *A. philippinensis*. This shows that paddy fields play practically no part in producing this species. The species in the paddy fields were *A. vagus*, *A. subpictus*, *A. hyrcanus*, *A. barbirostris*, *A. annularis*, *A. pallidus* and *A. culicifacies*. The following facts have been gathered about the paddy fields:—(*a*) The paddy fields usually remain dry from January to June and from November to December. (*b*) During the tilling of the land, organic matter such as cowdung and refuse are used as manure. It is possible that the large amount of organic matter present in the soil has an inhibitory effect on the breeding of the species in the paddy fields. (*c*) During most months the paddy fields have only a small amount of muddy water. (*d*) Transplantation of paddy is done during August and September usually.

(5) *A. philippinensis* has been found to breed in association with the following aquatic vegetation in the area:—Floating grass, Lemna, *Pistia stratiotis*, Algæ—Spyrogyra, Hydrilla, *Marsilea quadrifolia*, Azolla, *Ipomoea aquatica*, *Salvinia natans*, *Salvania cuculata*, Nymphæa and

Vallisneria spiralis. Of these the association of Pistia with *A. philippinensis* was specially studied and the results are given in a tabular form:

Table.

Year.	No. of times breeding places examined.	Breeding places with Pistia stratiotis.		Breeding places without Pistia Stratiotis.	
		With A. phillippinonsis.	Without A. philippinensis.	With A. philippinensis.	Without A. philippinensis.
1936 . .	1,257	6	320	2	929
1937 . .	1,185	17	577	8	583
1938 . .	2,010	261	824	112	813
1939 . .	1,757	174	478	49	1,056

This table brings out that in this area, removal of Pistia for controlling the breeding of *A. philippinensis* is not a practical proposition.

Acknowledgment.

Thanks are due to the following gentlemen for help received in the course of our work:—

(1) Lt.-Col. A. C. Chatterjee, I.M.S., Director of Public Health, Bengal.

(2) Capt. J. D. Sinha, Assistant Director, Malariology, Bengal Public Health Department.

(3) Dr. G. Sankaran, Professor of Biochemistry and Nutrition, A. I. I. of Hygiene, Calcutta.

REPORT OF THE PROFESSOR OF BIOCHEMISTRY AND NUTRITION.

(G. Sankaran, M.B., B.S.)

Staff.—During the year under review there has been no change in the regular staff of the section consisting of a professor, an assistant professor and two laboratory assistants. Dr. D. D. Mitra, a Nutrition Field Worker for Bengal and Assam employed by the Indian Research Fund Association and attached to the laboratories, tendered his resignation on the 5th of May 1939 on being appointed to the post of Water Analyst to the Corporation of Calcutta. No one has yet been recruited by the Indian Research Fund Association to fill in this vacancy and continue the useful field work in these two provinces. Dr. S. S. Mukherjee joined the laboratories as Experimental Cytologist on 1st of April 1939, under a grant from the Indian Research Fund Association. Mr. P. K. Seshan of the School of Tropical Medicine working under a grant from the Endowment fund was accommodated in the laboratories. Dr. C. Ghose has been a part time worker doing biochemistry of blood on behalf of the Section of Maternity and Child Welfare and the Chittaranjan Seva Sadan Lying-in hospital.

In the last year's report mention was made of the initiation of some new types of work consequent on the change in the head of the section. The appointment of a new Director during this year has resulted in further changes in the scope and outlook of the activities of the section. Early in the year under instructions from the Public Health Commissioner with the Government of India a note was prepared on the present condition and proposals for expansion of the Section, and formed the basis of discussions with the new Director when he took charge of the Institute. As a result of these discussions a few important improvements have been made in teaching and in other activities of the Section.

Teaching.—The syllabus for D. P. H., D. P. H. & Hy., and D. M. C. W., included a few lectures and demonstrations on Physiology and Biochemistry of Nutrition in Part II of the course of instruction. This year Nutrition is included in Part I. Also in the instruction particular emphasis is laid on the public health aspect of the subject of Nutrition. Physiology which in the past has been dealt only in connection with Nutrition has now been recognised to extend to some more aspects of Public health such as factors influencing human comfort, efficiency and health. This was mentioned in the note on the proposals for expansion of the Section already referred to as being well within the province of the Section of Biochemistry and Nutrition. The new Director too pointed out that adequate recognition is being given to the subject of Physiological Hygiene in many of the Public Health Institutions all over the world. Hence a syllabus has been drawn up on the subject of Physiological Hygiene to form part of instruction in Part I of D. P. H. course. The subjects Climatology and Meteorology are more rationally included in their relation to Physiology in this syllabus.

Research and Investigation.

Defective Vision and Vit. A Deficiency.—The visual photometer mentioned in last year's report and which was useful in a study of Vit. A deficiency among prisoners in a Calcutta Jail has been used in collaboration with the staff of the Opthalmological Department of the Medical College Hospitals, Calcutta, in an investigation into the causes of defective vision among the patients particularly those that attend the out-patient clinic. Quite an appreciable percentage of persons complaining of dimness of vision are found on careful opthalmological examination to have no defect of lens or of retina. Such cases have usually been classed as retro bulbar neuritis of unknown origin. An examination with the photometer and subsequent improvement with Vit. A containing foods such as cod and halibut liver oils showed that some of these cases are due to Vit. A deficiency. Other cases with various degrees of Hemeralopia, Xerosis, Bitot's spot, keratomalacia were also examined periodically with a view to determine the success and rapidity of cure with Vitamin A administration. Nearly a hundred cases have so far been examined and it is hoped to continue the work as a part of a scheme of investigation of preventible blindness in Bengal and its treatment by improvement of nutrition being undertaken in conjunction with Lt.-Col. Kirwan, I.M.S. Incidentally it is hoped that this work will enable us to assess the value of cheap locally producible fish liver oils and carotene containing vegetable oils. One case of colour blindness was examined with the photometer and showed that it had no relation to Vitamin A deficiency.

Red Blood Corpuscle Diameter.—Standard curves of mean red cell diameters for Bengalee population having been obtained from an examination of 50 healthy individuals during the course of last year, work was undertaken in collaboration with Dr. Napier to study cases of anaemia with a view to determine if the new technique would be more helpful in arriving at a correct diagnosis of the type of anaemia. 50 abnormal blood samples were examined and the relevent statistical figures obtained. The analysis of the results is in progress but we seem to see that classifying the various types of anaemias as macro or microcytic from the mean value of R. B. C. diameter alone is not justified and that the coefficient of variation of the diameters is of great significance.

The Maternity and Child Welfare Section is making use of the equipment in their study of bloods in pregnancy.

Dental Structure in Vitamin deficiencies.—The work of Dr. Mullick has shown us in these laboratories that dental tissue is very sensitive to calcium deficiency. We have now employed the technique in a study of the relation of vitamin deficiencies as well. Rat as a species is generally believed to synthesise all its requirements of Vitamin C. This belief is based on the normal growth of the animal when this vitamin was deprived in the food. That such apparently normal growth might be associated with structural and functional defects of body tissues is now being recognised from observations of many subclinical conditions. An experiment on rats with Vitamin C deficient basal diet and with basal diets supplemented with orange juice or pure ascorbic acid showed that dental structure is impaired in the course of two months. Further

experiments of a similar nature are in progress to determine the effects of Vitamin A, B_1 and D deficiency in the diets. The results so far available show that in Vitamin A deficiency the width of predentine progressively increases with the degree of deficiency. The structure of dentine too present certain abnormalities which are still under investigation.

The study of dental structure in human beings too has been taken up for investigation. This is particularly useful in not only demonstrating the present nutrition status of the individual but also his previous dietary history. It is like studying the life of a tree from the concentric rings found in the section of its trunk. This method would be most useful in the case of children for obtaining an insight into their previous nutritional condition. With this view we have collected a large number of deciduous teeth from children in different social classes and at different economic levels. Work on this material is still in progress.

Nerve degeneration in Vit. A Deficiency.—E. Mellanby and J. T. Irving have shown that characteristic degeneration in the nerve cells of the central nervous system takes place in Vitamin A deficiencies. It is possible that this could be made a specific test for Vitamin A deficiency. With experiments on rats we found that lesions first appear in the medulla at the region of crossing of the pyramidal tracts as early as six weeks on a Vitamin A deficient diet and before any eye symptoms appear. After eight weeks the lesions are very marked. So far we have not been able to trace any degenerative changes in the spinal cord described by the other two workers.

The Assessment of the level of Vitamin B_1 Nutrition in man.—Recently great advances have been made in the estimation of Vitamin B_1 by chemical methods, particularly in biological fluids. With certain modifications we have been able to develop a technique of estimating Vit. B_1 in as small a volume of urine as one c.c. containing as little as 1 μg of the vitamin. The accuracy of the method is seen from the fact that 95 to 96 per cent. of added vitamin could be recovered. We are using this technique to determine the average excretion of vitamin B_1 by normal individuals at different social and economic levels. The earlier studies from these laboratories made use of biological method of assay and were necessarily extremely limited in their scope. This present chemical method now makes possible an extensive survey to be made of the population under different conditions.

Proteins of Blood.—Proteins of blood in humans during health and disease has been a subject of intense research and their specific changes have been utilised in diagnosis. The gel formation of serum of kala-azar patients on addition of a drop of formalin first suggested by Dr. Napier in 1921 has been a useful clinical test. This gel formation is now known to be due to the increase of Euglobulin fraction of the proteins in kala-azar. Dr. Napier has extended the study to an investigation into the protein changes in blood in the various types of Anaemias. The clinical material is obtained from the Hospital for Tropical diseases and the biochemical estimations of protein fractions of blood such as fibrin, Euglobulin, pseudo globulin and albumin are determined in the Section. The progress of patients is followed with weekly estimations of protein fractions. So far 12 cases of anaemia were examined along with 4 cases of Kala-azar for comparison purposes. The results

obtained so far indicate that in all cases where haemoglobin content was low, the total proteins were also low and they tend to become normal as the haemoglobin level is raised to normal. Other findings are that the albumins and pseudoglobulins are considerably decreased and Euglobulins increased. The marked change in the euglobulin pseudoglobulin ratio observed in Kala-azar due to a great increase in euglobulin, has not been noticed in anaemia cases so far examined. Further work is in progress.

Blood Chemistry in Pregnancy.—In connexion with an enquiry into the physiology of normal pregnancy and common pathological conditions such as anaemia associated with pregnancy in Bengal being conducted by the Maternity and Child Welfare Section and the Chittaranjan Seva Sadan Women's Hospital, certain constituents of blood had to be estimated. These are the percentage of calcium, inorganic phosphorus and cholesterol in blood serum, and are being determined quantitatively in the section. It is proposed to obtain figures for a large number of normal and abnormal conditions. So far only about 25 patients have been examined. Further work is being continued.

Use of Photoelectric cell in Quantitative Biochemical estimation.—Increasing attention is now being given to methods of quantitative analysis where subjective observations are eliminated. Several costly equipment are now available for objective methods of determining depth of colour, turbidity and degree of fluorescence. An attempt was made to construct such apparatus locally as parts of the equipment are already available for other work. It was found that with a single Weston Photoelectric cell it is possible in conjunction with a sensitive galvonometer and potentiometer usually available in most biochemical laboratories to make objective quantitative measurements. Several details of the equipment were determined such as intensity of illumination colour filters and absorbers of ultra violet light. A satisfactory apparatus could be rigged up for estimations of most coloured liquids and is preferable to colorimeters and visual photometers. Quantitative estimations could be made in cases where precipitation and turbidity occurs. Lastly fluorometry is facilitated in such estimations as Vit. B_1 by the thiochrome reaction. During the course of the work the need for a workshop for the Institute was felt as outside agencies took far more time than was necessary and work on several occasions was held up.

Spectrographic work.

Vitamin A in Fish oils.—The investigations on the Vitamin A content of Indian fish were continued and report of it sent for publication to the Journal of Indian Medical Research. Further studies showed that in the method of preparations of the oil, the application of heat in contact with air as cooking in an open vessel caused a 20 to 60 per cent. loss of vitamin A. The maximum amount of vitamin and fat was obtained by Ether extraction at room temperature. Seasonal variation in Vitamin A and fat content was noticed among fish and during the spawning season they were both very low while the fish themselves continue to increase in size. The marine fish yield a large amount of

liver oil. One variety the Saw fish supplied by Indian Trawling Co., Ltd., is particularly rich, one fish liver alone giving as much as 15 pounds of oil containing 100,000 International units of Vitamin A per gram of oil. Some of the fish oils contained a large amount of carotene. There was good correspondence between Carr-Price blue and the spectrographic E values obtained particularly with Vitamin A rich oils.

In view of a considerable decrease in importation of Vitamin A rich cod and Halibut liver oils on account of War conditions it is desirable that local fish be exploited for production of liver oils for local consumption. Certain recommendations have been made to the Chemical Manufacturers Association of India and to the Director of Fisheries, Madras who are seriously considering the suggestions.

Vitamin A storage in human livers.—It is well known that most of the Vitamin A reserves of an animal is in the liver. The determination of such reserves of persons in health and disease is of considerable importance in nutrition studies. It is however not easy to obtain human material for such studies. Through the cooperation of the Police Surgeon, Calcutta, we managed to get livers from sixteen cases of autopsies performed in the Police Morgue. Death in these were due to a variety of causes such as accidents including road accidents, burns, suicide by hanging, heart failure, opium poisoning and snake bite. The persons belonged to lower middle and working classes. Both Vitamin A and carotene were estimated. High values for these were obtained in all the three cases of opium poisoning and a very low value in the only case of snake-bite. The significance of these findings is not yet apparent as the data is limited. Further work is being continued.

Blood Pigments.—Spectrographic examination of blood for sulphaemoglobin is being continued as a routine procedure in all cases of administration of sulphanilamide preparations in the Carmichael Hospital for Tropical diseases. On the appearance of sulphaemoglobin in the blood warnings were issued to stop the drug. It was found that M.B. 693 and Gombardol did not produce any derangement of pigments of the blood.

Several specimens of blood from different types of anaemia were examined for the presence of any new bands of absorption but in every case negative results were obtained.

Pigments in fungi.—Dr. S. R. Bose, Professor of Botany, Carmichael Medical College, Calcutta, was assisted in his studies of the pigments present in the poisonous fungi that cause destruction of hard woods. Absorption spectra of extracts in water, alcohol and pyridine of 14 fungi were photographed. The pigments are not due to coratinoid or xanthene group of pigments. The extracts were fluorescent in ultra violet light.

Absorption spectrophotometry was also carried out on a large number of mustard oils for the Epidemic Dropsy enquiry and a number of cortical hormone preparations for the Black Water Fever Enquiry.

Tissue Culture Enquiry.—This enquiry financed by the Indian Research Fund Association was started on the 1st of April 1939 with the object of studying certain aspects of nutrition by the tissue culture technique. It is proposed to study the mechanism of the utilisation of amino acids by the metazoan cells. Several successful cultures in vitro of connective tissue and epithelial cells from the embryo chick have been obtained in hanging drop preparations which is very suitable for microscopic study. The factors governing an active growth are being studied before applying the technique to the projected study of cell nutrition. Recently experiments with duck embryos were undertaken with successful results as fertile eggs are difficult to obtain during certain seasons of the year.

During the course of the year the members of the Section have taken active part in the proceedings of the Public Health Society, Physiological Society and the Biochemical Society. Active co-operation was given to the Calcutta Corporation in planning the first Food Exposition held in India. Demonstrations of the various research activities of the Section were given for the benefit of the Calcutta Medical College Reunion. Our close contact with the School of Tropical Medicine was increased by our Section presenting in one of their monthly meetings a few applications of spectrographic methods in medical and nutritional problems. Advice and guidance were given to a young physicist for the study of problems of nuclear physics in relation to biological problems.

It is a pleasure to record that the first Doctorate degree of a University for a worker of the Institute has been awarded to Dr. D. N. Mullick for work carried out in this section.

Lastly the writer wishes to acknowledge with thanks the help and co-operation received from Colonel R. N. Chopra and other members of the staff of the School of Tropical Medicine; Dr. J. B. Grant, Director, and the various members of the staff of the All-India Institute of Hygiene and Public Health.

REPORT OF THE PROFESSOR OF MATERNITY AND CHILD WELFARE.

(Dr. L. S. Ghosh, M.B., CH.B., D.P.H., D.T.M. & H., W.M.S.)

The year has largely been one of assessment and readjustment of the existing facilities offered by the section to the whole academic and research programme of the Institute.

A new syllabus for the course for the Diploma in Maternity and Child Welfare was drawn up and circulated for opinion and suggestions. Changes were proposed also in the small unit of instruction given by the section in the course for the diploma in public health, both as regards its systematic and practical content.

The methodology of the work of the Centre was scrutinised in regard to the three avowed objects of its inception, namely, that of providing a teaching and demonstration centre for post graduate students of this branch of public health work; that of serving for the collection of data for research work upon the problems associated with mother and child care; lastly that of carrying on intensive welfare work amongst women and children in the area served by the Centre.

The changes effected and proposed in the clinic routine are discussed in the portion of the report dealing with the work of the Centre during the year.

Teaching.—One student was admitted to the course for the Diploma in Maternity and Child Welfare; she did not enjoy good health during the year and was unsuccessful in the second part of the examination for the diploma.

Instruction in accordance with the former syllabus was given to the D.P.H. students with the inclusion of the medical examination of three school children by each student, which was made compulsory.

Research.—In collaboration with the Professor of Vital Statistics and Dr. Subodh Mitra, Honorary Obstetrical Surgeon to the Chittaranjan Seva Sadan, investigation into the anæmias associated with pregnancy was commenced. Dr. Mitra provided the services of Dr. S. Ghose, who carried out the biochemical estimations. The work was started in August. Fifty-three samples of blood were submitted to complete examination, twenty-eight from patients of the Chittaranjan Seva Sadan and twenty-five from women attending the Institute Clinic. This work will be continued in 1940.

One hundred and forty blood films were examined and 96 reticulocyte counts made from clinically "well" pregnant women, and also from pregnant women with mild symptoms and signs of anæmia, attending the clinic.

With a view to conducting a survey, a large scale map of the area served by the Centre was prepared and with the co-operation of the Corporation authorities an attempt was made to plot all premises in the area, on the map.

Great difficulty was experienced in certain parts of the area owing to defective numbering of houses and naming of streets. The map can now be regarded as being as complete as circumstances permit.

With the object of the ascertaining whether in the area the intervals between the date of birth, registration of birth and the first visit by the centre health visitor for infant care had lessened during the seven years since the establishment of the Centre, the returns of 1934-1939 were investigated.

It was found that the returns of registration received from the Chief Medical Officer of the Calcutta Corporation during 1934-1937 had not been preserved and the information relating to those years is now being obtained from the original records in the Health Office of the Corporation. The records of the Clinic were submitted to the Assistant Prof. of Vital Statistics with a view to the extraction of data of value in the preparation of teaching material primarily and for purposes of research.

It was finally decided that with the present cards and method of recording, except that of a very limited nature, extraction of relevant data could not be effected.

Some time has been given to the planning of new cards.

Report of the work of the Centre.—*General Remarks.*—The absence of a clerk to handle the returns of the clinic is keenly felt, especially as it is planned to make extractions from the figures, twice weekly and monthly, during the current year.

The preparation of the annual report of the Centre throws a very heavy strain upon all members of the staff during the last and first months of the year and there seems little doubt that adequate clerical assistance would facilitate rapid and satisfactory analysis of returns. All members of the technical staff of the centre took part in the collection of figures for the annual report this year, and they were quick to appreciate certain defects in the recording of information and transference of data.

Owing to the fact that it has not been the custom to give all infants and toddlers on card a new number at the beginning of each calendar year, without, in the case of toddlers, searching all cards from 1935 to 1939, no analysis of the respective age groups could be made. For this reason figures are given separately for the total number " under care during the year " and in greater detail of the same groups " first put on card during 1939 ".

In all activities of the centre one is impressed by the need for public health workers who have had a training in general nursing. The type of work that is done by the Public Health Nurse is clearly defined in the routine of the centre by its absence. The Health Visitors attached to the centre do excellent work which is highly appreciated by the medical members of the staff and the public alike. In the observation ward, in the domiciliary care of infectious diseases of childhood, in the defective vaccination returns and in many small details of routine is felt the need of a training in nursing allied to a training in public health. It is hoped that the staff of the centre will be strengthened in this way in the near future.

The routine of the centre continued as usual, *i.e.*, two clinics were held weekly in the morning, and a mothercraft class on one afternoon. Home visits were paid on three mornings and two afternoons each week except for postnatal visits and other special visits which were paid on clinic days also.

As the numbers attending the mothercraft class showed no increase, additional material for demonstration purposes was provided and in order to stress the social aspect of the meeting, the preparation and serving of tea to the group was instituted. This has proved popular and is now done by one of the members of the class at each meeting. A cooking stove and kitchen utensils have been ordered and it is hoped that not only will demonstrations in the preparation of foods for infants and toddlers be given by the staff, but that mothers will demonstrate the preparation of dishes commonly eaten in their communities, portions of which will be submitted to analysis in the nutrition section, along with the weights of the raw materials employed.

Nursery School.—Beyond the provision of some additional instruction material, no changes were effected in the school programme. Consideration of the plans submitted for the provision of improved accommodation was postponed owing to considerations affecting the whole programme of demonstration work at the Institute. The conditions under which the " school " was housed were far from ideal, the school room being small, overlooking a narrow rather insanitary lane and the children sharing sanitary accommodation with women and children attending the clinic.

The nursing school teacher was sanctioned leave to take the course conducted by Dr. Maria Montessori in South India for the training of nursery school teachers, with effect from the 11th November, and the School was not reopened during the remainder of the year.

Midwifery Service.—Only one midwife was attached to the Centre from the 1st January until the 31st July, when she resigned. On the 22nd September, the two midwives appointed reported for duty. During the period from the first August till the twenty-first September, cases already booked were conducted by the Health Visitors, and a qualified midwife, in private practice, known to the staff, was introduced to those women who desired to book for delivery by the Centre midwife with a view to preventing the employment of an untrained midwife.

These changes in staff seriously affected the midwifery returns of the Centre, and reduced the number of mothers who received " complete " care, *i.e.*, paid at least three antenatal visits, were delivered by the centre staff and received care during the first ten days of the puerperium followed by a physical examination at the clinic four to six weeks after delivery. Apart from the inclusion of weighing the infant at birth, in the duties of the midwife, no change has been made in the routine of the service.

Home Visits.—This work continued without interruption throughout the year as owing to the kindness of Dr. Biggar, Secretary of the Sir John Anderson Health School, a Health Visitor was made available to undertake relief work for two months as sanctioned by Government so that each Health Visitor was able to enjoy a month's leave. [The nature of the work makes it almost impossible for good work to be done by the visiting staff unless a month's leave is sanctioned each year, —in the case of the midwives two weeks at least—, and it is hoped that the provision of leave relief will be regarded as a fixed item in the annual programme of the Centre.]

A scrutiny of the home visits paid during 1938 revealed the fact that 3,322 visits were paid to homes from which no visit to the clinic was paid. It was also apparent that a high proportion of infants were receiving milk other than breast milk under one month of life.

In order to provide more clear cut types of service for demonstration purposes and in order to ascertain whether more intelligent instruction regarding, and management of, breast feeding, would lower the number of infants under one month not on breast milk, it was decided that ten postnatal visits instead of two or three irregularly spaced should be paid for this purpose by the health visitor to all women who in the antenatal period had paid at least one visit to the clinic, regardless of the agent of delivery, unless a medical practitioner were in attendance.

In order to attempt further systematisation of the visits the various types of visit ordinarily paid to antenatal and postnatal cases, infants and toddlers were scheduled, and temporary forms prepared for the statement of each type of visit paid and the time expended upon it. This should provide information on which the work may be further planned.

A weekly conference of all technical members of the staff of the Centre was held weekly from the beginning of October. It proved most useful in planning the work and was a welcome feature of the routine.

Clinic Routine.—In order to relieve the Health Visitor for postnatal care, it was decided that except in special circumstances, to be determined by the Health Visitor, unless one visit were paid to the clinic for each two home visits, no further visits could be paid except about the time of delivery in an antenatal case, or time of vaccination in the case of an infant.

It should thus be possible to plot the areas of poor response and plan a campaign of concentrated approach at a later date.

As far as possible in all antenatal cases attending the clinic the blood was submitted to the Wasserman or Kahn Test. Pelvic measurements were taken in the case of all primiparæ, and from the month of June in the case of multiparæ also.

Observation Ward.—This is at present housed in the small room on the first floor adjoining the treatment room and is crowded when three children are under care at a time. Should the nursery school not reopen in the clinic premises, the treatment room could be removed to the school room on the ground floor and the present treatment room be used as the observation ward, as it is better lighted and much larger with accommodation for four cots and other equipment.

Some new furniture and cots were ordered for this unit. The part played by the observation ward is a very important one, although the work was handicapped during the year under review by changes in, and inadequacy of, staff. Here the need of a trained nurse is badly felt and indeed suitable and adequate staff is needed to obviate the necessity of infants under observation being carried to and from home daily, which alone may aggravate the condition of weakened or premature infants. The ward is popular and the care is designed to include drugs to the minimum extent, the mother is in every case encouraged to remain with the child and learn the proper routine by assisting in the care, she is also taught to appreciate the significance of improved weight.

The care of premature and immature infants requires to be extended.

Treatments.—These are restricted to minor ailments, the lesser eye and ear conditions, prickly heat, boils, early alimentary, and respiratory disorders. Corrective exercises and massage can be undertaken and demonstrated only in the observation ward.

Here, too, is felt the need of a Public Health Nurse: in the centre, corrective exercises and massage do not occupy the place due to them in the care of the preschool group.

Immunisation.—Smallpox vaccination was badly recorded and little was carried out at the centre. Steps are being taken to effect some improvement here both by home visits and at the clinic. A scrutiny of the vaccination returns of the Corporation may prove of great help in meeting the problem.

Immunisation of whooping cough contacts was carried out whenever a case was detected at the Centre either in the clinic or in the nursery school. This was understood and appreciated by the mothers.

Anti-typhoid inoculation.—This was carried out as usual in regard to the nursery school pupils.

Infectious Diseases.—*Among antenatal cases;* cholera and smallpox occurred, tuberculosis, syphilis, gonorrhea and scabies were detected.

Among lactating mothers; syphilis, gonorrhœa and scabies were detected.

Among Infants. Occurred cases of measles, whooping cough, smallpox, syphilis and scabies.

Among toddlers occurred cases of measles, whooping cough, typhoid fever, syphilis and scabies.

The figures are given in General Table "F" and also the number of cases treated.

The increasing difficulty of obtaining drugs for antisyphilitic treatment as a result of war conditions resulted in inadequate treatment being given in certain instances.

Mercurial injection was in one case the only form of treatment available. It is hoped that a supply of sulpharsenol will be made available in a short time.

As regards ophthalmia neonatorum, in the case of three infants, delivered by dais, early postnatal care by the Centre Health Visitor checked eye infection.

Health of the Staff.—The health of the staff was, on the whole, good. Throat swabs were taken from all technical staff attached to the clinic. It is proposed to make this a three monthly routine:—in the event of probable pathogens being detected a gauze mask will be worn during attendance at a delivery, unless the infection merits withdrawal from duty temporarily.

Staff of the Clinic.—Apart from the Professor and Assistant Professor, Maternity and Child Welfare, who function as medical officers, the staff of the Clinic consists of two Health Visitors, two midwives, and some inferior staff.

I am indebted to all members of the staff of the section for the interest taken by them in work and the cheerful co-operation with which many new problems and changes were faced.

REPORT OF THE PROFESSOR OF SANITARY ENGINEERING.

(Mr. P. A. Midha, M.Sc., M.Eng., M.I.Struct.E.)

Staff.—Owing to administrative difficulties, no subordinate staff was appointed for nearly a year since the formation of the Section. One Draftsman was appointed in January 1938 and the Technical Assistant in November 1938. The remaining two posts, the second Draftsman and the Fitter Mistry, have not yet been filled. Steps are, however, being taken to fill these vacancies.

Teaching.—Apart from the usual course of lectures and demonstrations for D.P.H. and D.P.H. & Hy. students, a special student in Malariology attended a short course of lectures in "Engineering Methods of Malaria Control" early this year and a student of D.P.H. (Irregular) course received special lectures in Sanitary Engineering and attended important practical demonstrations in connection with his training, in May 1939. The student of Maternity and Child Welfare course attended classes along with the D.P.H. and D.P.H. & Hy. students.

Syllabus.—In connection with the general scheme of re-organisation the syllabus in Sanitary Engineering was re-written this year, so as to include discussion of relevant portions of Sanitary Law which formerly was being treated as a separate subject. The practical work in Sanitary Engineering is dealt with under the headings, (*a*) Drawing and Map Reading, and (*b*) Practical Demonstrations, urban and rural.

Equipment.—No further equipment arrived until late in the year, and even up till now a number of items which have been formerly sanctioned have not been supplied by firms, owing to serious delays consequent upon War. Further requisitions have been submitted for additional equipment, which are under consideration.

Unfortunately the hope expressed in the last Report that this year would see the laboratory and the Museum adequately equipped for teaching and research has not been fulfilled.

Field work.—Since last November, the Section has been engaged on a scheme of Malaria Control for some villages in Burdwan District. The survey work has been finished and plans and estimates are under preparation. It is hoped that before long the Section would be called upon to take up the actual control work in the field in connection with this scheme, and funds and necessary facilities would be forthcoming for carrying the scheme through to completion.

The Section looks forward to further opportunities of this nature in the near future.

The Section also hopes to engage itself in laboratory and field research as soon as necessary equipment for such work becomes available.

The institution of special courses for Malaria Engineers, Municipal Engineers, and other classes of workers, referred to in the last Report,

has been kept in abeyance and will be taken into consideration at a later date, possibly next year, after the general reorganisation of the existing courses which is in progress is complete.

Acknowledgments.—Our acknowledgments are due to the various firms and other sources for presentation to this Section of further items of useful literature, lantern slides, models, etc., during the course of the year.

TUBERCULOSIS INQUIRY.

(Dr. A. C. Ukil.)

Financed by the Indian Research Fund Association.

During the year under report the Staff of the Inquiry were active both at the Institute and outside. The work of the Inquiry comprises teaching, research and offering help and advice to medical and public health authorities of different provinces regarding the problem of tuberculosis in India.

Teaching.—Dr. Ukil, Dr. P. K. Sen and Dr. S. R. Guha Thakurta participated in the All-India Post-graduate Course in Tuberculosis organised by the Tuberculosis Association of India, in the Post-graduate tuberculosis Course for Public Health Workers of Bengal organised by the Director of Public Health, Bengal and in the post-graduate training of Doctors sent by the Bihar Government. The Inquiry also participated in the training of D.P.H. students in Tuberculosis.

Research.—Dr. Ukil, Dr. Sen and Dr. M. M. Bose, with the voluntary co-operation of the Angus Jute Mill authorities were engaged in the investigation of tuberculosis in relation to Industry among the workers of the Mill at Angus. The work is being continued. Up to the present, 3,008 workers from various provinces have been examined, of whom 89·3 per cent. have given a positive Mantoux reaction and 14·5 per cent. radiological evidence of active pulmonary tuberculosis. The frequency of infection has been found to be almost equally distributed over all age groups and about the same in both sexes. The highest percentage of disease was found in the age group - 40-45. The "Winding" department of the industry gave the highest percentage of strong reactors (51·7 per cent.) and the "Preparing" section the lowest (16·1 per cent.). Milder degrees of bronchitis were detected in 15·5 per cent., dermatitis in 8·4 per cent. and naso-pharyngeal catarrh in 2·4 per cent. of the cases examined. A survey among the contacts of known cases has given a positive reaction in all the contacts.

A survey is also being conducted into the dwellings and their surroundings, the social customs and habits of the workers, financial status, nutrition, general mortality, tuberculous morbidity and mortality.

Dr. Ukil and Dr. Guha Thakurta are investigating into the problems of tuberculosis in home contact children. To date, 917 children aged 15 years and under have been examined. The results so far obtained show 67·9 per cent. positive reactors, 11·6 per cent. with active tuberculous pulmonary lesions, 6 per cent. with arrested lesions and 29 per cent. with tracheo-bronchial adenopathy (by radiographic examination).

The data are being analysed according to age and nature of contact (source, closeness, continuity and duration). The percentage of positive reactors was found to vary *directly* with age and the incidence of demonstrable X-ray evidence of disease to vary *inversely* with age. The percentage of positive reactors has been found to be higher among contacts showing parenchymal lesions than among those showing tracheo-bronchial adenopathy. The incidence of a combination of active and arrested lesions and of tracheo-bronchial, as well as the different

varieties of lesions separately taken varies directly with the intensity of the tuberculin reaction. The tubercular homes are also being surveyed.

In order to find out the part, if any, which *bovine* infection plays in the incidence of tuberculosis in this country, Dr. Ukil and Guha Thakurta were engaged in typing out the strains of tubercle bacilli isolated from pathological materials, chiefly from non-pulmonary sources. Out of 212 strains thus far typed out, all have proved to be of the *human* type.

To find out the increase in the infection rate, if any, in certain areas investigated by Dr. Ukil *et al* 10-12 years ago, Dr. Guha Thakurta, in collaboration with Dr. Bose, is now conducting tuberculin surveys of the same areas. The work is being continued and the results so far obtained show a definite increase of tuberculous infection over the previous figures.

Miscellaneous Work.

As usual, this Inquiry had to answer many enquiries from and offered advice to the medical and public health authorities in different provinces. In addition to participating in several courses of post-graduate teaching and editorial aid to the Indian Medical Gazette and other papers, a note on the Problem of Tuberculosis in Industrial Workers in India was prepared, which was presented by Sir Alexander Russell at the May, 1939 session of the Office International d'hygiene publique and which has since been published in its bulletin. The Inquiry also contributed papers to the Tuberculosis Workers' Conference and participated in the work of the All-India Tuberculosis Survey Committee and Tuberculosis Advisory Committee, I. R. F. A.

EIGHTH POST-GRADUATE COURSE IN TUBERCULOSIS.

(Dr. B. K. Sikand, M.B.B.S., D.P.H.)

With the object of helping the general medical practitioners to improve their knowledge about the modern methods of diagnosis, treatment and prevention of tuberculosis, the King George Thanksgiving Anti-Tuberculosis Fund (which was incorporated into the Tuberculosis Association of India on the 24th February, 1939) organised the 8th post-graduate course in tuberculosis at the All-India Institute of Hygiene and Public Health, with the permission of the Surgeon-General with the Government of Bengal and the Director of the Institute, from the 30th January to the 25th February, 1939. Facilities available at other institutions in Calcutta, *viz.*, the clinics of Bengal Tuberculosis Association, the Medical College Hospitals and the Jadabpur Tuberculosis Hospital, were freely utilised for the course.

Thirty-one students were selected for training at the course with due regard to their past experience in tuberculosis and future facilities for the treatment of the disease. The selection was, as far as possible, distributed equitably over different provinces with the exception of the Bengal Province wherefrom 10 doctors were chosen in consonance with the policy of the headquarters to allot, comparatively, a greater number of seats to the candidates of the province in which the course is organised.

The course commenced at the Institute on the 30th January with a welcome by Dr. B. K. Sikand, the then Organising Secretary of the Fund, followed by an opening address on "Tuberculosis in relation to Public Health" by Lt.-Col. A. C. Chatterji, Director of Public Health, Bengal. The classes were held from 9 A.M. to 4 P.M. every day and the approved programme covering a large range of aspects of the tuberculosis problem was observed. The following gentlemen participated in teaching:—

Dr. A. C. Ukil,
Dr. R. B. Lal,
Dr. K. V. Krishnan,
Dr. P. K. Sen,
Dr. N. Mukherji.
Lt.-Col. J. L. Sen,
Dr. M. N. De,
Dr. S. G. Galstaun,
Dr. P. Chatterji,
Lt.-Col. F. J. Anderson,
Dr. K. N. De,
Capt. S. C. Dutt,
Dr. C. Frimödt-Møller,
Dr. J. Lowe and
Dr. B. K. Sikand.

The King George Thanksgiving (Anti-Tuberculosis) Fund did not charge admission and tuition fees from the students, and paid them second-class return railway fares up to a maximum of Rs. 100 per head.

All the candidates made full use of the opportunities offered to them and showed keen interest in the improvement of their knowledge.

We are deeply grateful to all those who co-operated with us in contributing to the success of the course by delivering lectures to the students and by affording us the facilities available at their institutions for demonstrations. In particular, we would like to express our thanks to Dr. A. C. Ukil, who has been of immense help to us in the organisation of the course.

APPENDIX I.

Provinces from which students have come.

Provinces.	1932-33.	1933-34.	1934-35.	1935-36.	1936-37.	1937-38.	1938-39.	1939-40.	Total.
Bengal	18	19	11	6	16	16	14	10	110
Bihar	1	1	..	1	2	4	4	7	20
United Provinces	..	1	2	11	4	2	3	1	24
Bombay	..	..	..	..	2	1	1	..	4
Punjab	..	2	2	2	1	3	3	6	19
Orissa	..	..	..	..	..	2	..	..	2
Madras	..	1	4	..	4	1	2	5	17
Assam	..	..	..	1	1	..	1	..	3
Burma	2	1	1	3	..	1	..	..	8
North-West Frontier Province	..	..	2	..	2	1	..	..	5
Central Provinces	..	..	..	..	1	1	1	..	3
Hyderabad State	2	2	..	1	..	2	3	2	12
Mysore State	..	2	..	1	..	..	..	..	3
Travancore State	..	2	..	..	..	..	1	..	3
Cochin State	..	..	..	..	1	..	1	..	2
Cooch Bihar State	..	..	..	..	..	..	..	1	1
Coorg	1	..	..	..	..	..	..	..	1
I. M. D. (Anglo-Indian)	..	..	1	..	2	..	..	..	3
E. B. R. (European)	..	..	1	..	..	..	..	..	1
A. B. R. („)	..	..	..	..	..	..	1	..	1
I. M. S.	..	..	..	..	..	..	1	..	1

Services to which students since 1933 have belonged.

Services.	1932-33.	1933-34.	1934-35.	1935-36.	1936-37.	1937-38.	1938-39.	1939-40.	Total.
Indian Medical Service	..	..	..	..	..	..	1*	..	1
Indian Medical Department	..	..	1	..	2	2	1	..	6
Provincial Medical Service	..	..	1	1	5	1	..	..	8
Provincial Public Health Service	2	..	2	3	..	4	2	5	18
Women's Medical Service	..	1	..	..	1	..	..	..	2
Indian States Service	2	5	2	2	1	2	5	4	23
Public Health Service under Local Bodies	1	5	3	2	8	3	11	9	42
Railway Service	..	1	1	..	..	1	3	1	7
Service under other Agencies (Mercantile firms, Shipping Cos., etc.).	..	..	..	..	..	1	..	1	2
Unattached	19	19	14	18	19	20	13	12	134

* One member of the Indian Medical Service was admitted to a part of the D. P. H. course.

Courses which students have followed since 1933.

Courses.	1932-33.	1933-34.	1934-35.	1935-36.	1936-37.	1937-38.	1938-39.	1939-40.	Total.
D. P. H.	24	29	18	22	25	25	27*	29	199
D. P. H. & Hy.	..	..	4	..	5	5	4	2	20
D. M. C. W.	..	2	2	..	1	1	1	1	8
Biochemistry and Nutrition . . .	..	..	..	..	..	2	1	..	3
Vital Statistics and Epidemiology . .	..	..	..	2	..	1	..	..	3
Malariology	..	..	..	..	3	..	1	..	4
Composite Course	..	..	..	..	1	..	1	..	2
D. Sc.	..	..	..	2	1	..	1	..	4

* A member of the Indian Medical Service was admitted to a part of the D. P. H. course.

Services to which D. P. Hs. since 1934 have been appointed.

Year.	PUBLIC HEALTH DEPARTMENTS.							NOT IN PUBLIC HEALTH SERVICE.				GRAND TOTAL.
	Government.			Others.			TOTAL.	Private practice.	Unemployed.	Unknown.	TOTAL.	
	Central.	Provincial.	Institutions.	States.	Railway.	Miscellaneous.						
1934 . .	1	1	2	3	2	..	9	1	..	8	9	18
1935 . .	..	8	2	4	..	1	15	2	..	3	5	20
1936 . .	..	12	2	1	..	..	15	5	..	1	6	21
1937 . .	..	4	1	2	..	..	7	11	..	6	17	24
1938 . .	1	8	3	..	..	..	12	5	..	9	14	26
1939 . .	..	9	..	..	2	1	12	1	3	3	7	19
Total .	2	42	10	10	4	2	70	25	3	30	58	128

Records prior to 1934 not available.

APPENDIX II.

List of papers published by the Institute during 1939.

I.—*Section of Vital Statistics and Epidemiology.*

1. Lal, R. B., Ghosal, S. C. and Mukherjee, B.	Investigations on the Variations of Vibrios in the House Fly. Ind. Jl. Med. Res. 26, 3rd Jan. 1939.
2. Lal, R. B. and Roy, S. C. .	Investigations into the Epidemiology of Epidemic Dropsy, Part VII. Further Field Studies and Controlled Experiments. Ind. Jl. Med. Res., Vol. XXVIII, No. 1, July 1939, pp. 191-20.
3. Lal, R. B., Mukherji, S. P., Roy, S. C. and Sankaran, G.	Investigations into the Epidemiology of Epidemic Dropsy, Part VIII. Studies on the Nature and Origin of certain (?toxic) substances present in the supplies of mustard oil associated with outbreaks of Epidemic Dropsy—*Ibid*, pp. 207-224.
4. Swaroop, Satya and Lal, R. B.	Mechanical Tabulation as an aid in Periodogram analysis—(Sent for publication in the Supplements to the Journal of the Royal Statistical Society).

II.—*Section of Biochemistry and Nutrition.*

1. Napier, L. E., Sankaran, G., Swaroop, S. and Narasimha Rao, M.	Hæmatalogical studies in Indians, Part X. Mean Red Cell Diameters; Standard curves for a Bengalee Population.
	The Indian Journal of Medical Research, Vol. XXVII, No. 1, July 1939, pp. 253-278.
2. Lal, R. B., Mukherjee, S. P., Roy, S. C. and Sankaran, G.	Investigations into the Epidemiology of Epidemic Dropsy, Part VIII. Studies on the nature and origin of certain (?toxic) substances present in the supplies of mustard oil associated with outbreaks of Epidemic Dropsy.
	The Indian Journal of Medical Research, Vol. XXVII, No. 1, July 1939, pp. 207-224.
3. Sankaran, G.	Tissue culture.
	Science and Culture, Vol. V, No. 5, November 1939.
4. Guha, R. C. and Ahmad, B. .	Observations on the Vit. B, excretion of four healthy subjects living on different Indian Diets.
	Indian Journal of Medical Research, Vol. XXVII, No. 2, October 1939.
5. Ahmad, B.	Vitamin content of Indian foods and its relation to the state of Nutrition of the population.
	Proceedings of the Sixth Pacific Science Congress, California, 1939.
6. Ahmad, B.	Nutrition studies in India.
	Science and Culture, Vol. V, No. 2, August 1939.
7. Ahmad, B.	Impressions of an educational tour of the Universities of America and Europe.
	Science and Culture, Vol. V, No. 3, September 1939.

8. Ahmad, B.	Certain aspects of present day Biochemical and Nutritional Research in America and Europe. Science and Culture, Vol. V, No. 4, October 1939.
9. Seshan, P. K . . .	Spectroscopy in Medical and Biological Research. Science and Culture, Vol. IV, No. 9, March 1939.
10. Narasimha Rao, M. . .	Diet and Peptic Ulcer. Indian Medical Gazette, Vol. 74, 1939, p. 167.

The following Papers were read in the Proceedings of the twenty-sixth Indian Science Congress, Lahore, 1939.

SECTION X.—PHYSIOLOGY.

1. Mullick, D. N. . . .	Estimation of Inorganic Phosphorus by absolute colorimetry.
2. Narasimha Rao, M. and Sankaran, G.	Subclinical Vit. A deficiency studied by a Photometer.
3. Mitra, D. D. and Sankaran, G.	Applicability of Rotter's Test in field investigations in the determination of Vit. C deficiency.

II.—*Tuberculosis Inquiry.*

1. Chatterjee, P. K. and Ukil, A. C.	Some experiences in gold therapy in pulmonary tuberculosis, Trans. Med. Coll. Re-Union, 10th Session, December 1938.
2. Sen, P. K.	Relapse in cases of pulmonary tuberculosis, *ibid.*
3. Ukil, A. C.	Le probleme de la tuberculose chez les travailleurs de l'industrie dans l'Inde, Bull. Office Inter. d'Hygiene publique, Tome XXXI, No. 7, July, 1939.
4. Ukil, A. C.	Tuberculosis among Women in Bengal, Journ. Beng. Tub. Assocn., Vol. IV, No. 10, August 1939.
5. Ukil, A. C. and De, K. N. .	Branchiectasis—its etiology, pathology, diagnosis, prognosis and treatment, Ind. Med. Gazette, Vol. LXXIV, No. 9, September 1939.
6. Sen, P. K.	Pneumonoconiosis with special reference to Silicosis, Anthracosis and Tuberculosis, *ibid.*
7. Ukil, A. C.	Classification of stages of Pulmonary Tuberculosis and of discharge results, read at the All-India Tuberculosis Workers' Conference, November 1939.
8. Ukil, A. C.	Tuberculosis and Legislation, *ibid.*
9. Sen, P. K.	Tuberculin test as a guide to diagnosis of Tuberculosis, *ibid.*

APPENDIX III.

Tables and analysis of figures relating to the Maternity and Child Welfare Centre attached to the Institute.

Index of Tables.

General Tables.—"A", *Monthly Record of Clinic Attendances*, separating first visits and revisits, of "prenatal" and "postnatal" cases "infants" and "toddlers" showing the percentages of each type to the total visits paid.

"B" *Monthly Record of Home Visits, separating* "prenatal" "postnatal" "intranatal" "infant" and "toddler" indicating those paid by a Health Visitor and by a Midwife, and showing the percentages of each type to the total visits paid.

"C" *Monthly Record of Domiciliary Midwifery* showing cases "booked by the centre midwife" "sent to hospital" "infants born before arrival" the incidence of postpartum hæmorrhage, the condition of the infant up to 3 months, health of the mother during the postnatal period, and the maternal mortality.

"D" *Monthly Record of Children under Observation* showing the age groups, in the case of infants whether premature or not, and if mother was alive, reason for observation, the degree of co-operation given by the parents, and the time under observation according to each age group.

"E" *Monthly Record of Nursery School Children* showing the age groups represented, the average monthly attendances and the causes of sickness among the children in relationship to age.

"F" *Monthly Record of Occurrence or Detection of Infectious Diseases* among prenatal cases, infants and toddlers.

GENERAL TABLE " A ".

Monthly Record of Clinic Attendances during 1939.

Month.	Prenatal.		Postnatal.	Infant.		Toddler.	
	First visits.	Revisits.	Visits.	First visits.	Revisits.	First visits.	Revisits.
January	11	50	95	13	224	7	399
February	19	61	110	18	199	4	275
March	12	18	101	13	214	14	249
April	20	99	65	13	203	6	216
May	17	71	48	9	143	9	225
June	18	96	58	18	190	5	252
July	27	81	37	15	198	8	217
August	16	125	59	23	185	2	219
September	20	122	32	7	192	13	161
October	30	139	67	28	246	19	291
November	23	113	80	24	206	12	331
December	11	133	63	22	223	5	315
Total	224	1,118	825	203	2,423	104	3,090
Prenatal total visits = 1,342			Postnatal total 825	Infant total visits = 2,626		Toddler total visits = 3,194	
Per cent. of Total visits 100 per cent. = 7,987.		16·8	10·3	34·1		39·8 (app.)	

GENERAL TABLE "B."

Monthly Record of Home Visits.

Month.	Prenatal.		Number of women visited.	Postnatal.		Number of cases visited.	Intranatal.	Infant.	Toddler.
	Number of visits paid by			Number of visits paid by			Number of deliveries conducted.	Number of visits paid.	Number of visits paid.
	H. Visitor.	Midwife.		H. Visitor.	Midwife.				
January	67	2	27	..	37	19	4	261	157
February	66	23	29	..	16	5	2	254	171
March	84	4	30	..	35	14	5	270	103
April	70	8	16	..	58	19	7	193	76
May	70	5	27	81	52	9	6	209	63
June	58	5	16	42	53	6	3	179	48
July	64	3	14	..	..	4	..	103	51
August	57	..*	12	32	..	7	3	139	60
September	70	..*	26	..	..	9	..	122	55
October	45	21	6	62	68	14	6	161	34
November	43	14	16	40	74	9	4	155	67
December	48	32	18	50	74	10	5	184	61
Total	742	117	237	307	467	125	45+	2,180	946
	Prenatal total visits =859			Postnatal total visits =774			Intranatal total visits =49	Infant total visits =2,180	Toddler total visits =946
Per cent. of total home visits	17·8				16·0		1·0	45·3	19·9
	100 per cent. =4,808								

* No midwife attached to the centre.

In 552 working hours an average of 2,090 home visits were paid by each Health Visitor yielding an average of 3·7 visits per hour in each case.

The number of postnatal visits does not include visits paid by the Assistant Professor when called upon. 6 such visits were paid during the year.

GENERAL TABLE "C".

Record of Domiciliary Midwifery.

Months.	Cases booked.	Sent to Hospital.		Infants born before arrival.	Post-partum hæmorrh-age.	Infant well. —3 months.	Mother well.	Postnatal Period.		Maternal Mortality.
		Forceps.	Caes. S.					Complaint anæmia.	Rise of Temp.	
January	6	..	..	..	..	6	6	..	..	..
February	2	..	..	1	1	2	1	1	..	..
March	5	1	1	1	..	5	3	1	..	*1 following caesarian section.
April	7	..	..	2	..	7	6	..	1	..
May	8	..	..	1	..	8	7	..	1	..
June	3	..	..	..	..	3	3	..	..	..
July	..	..	..	..	..	..	..	..	..	..
August	3	..	..	..	..	3	3	..	..	..
September	..	..	..	..	..	..	..	..	..	..
October	6	..	..	1	..	6	5	1	..	..
November	4	..	..	1	..	4	3	..	1 malaria.	..
December	5	..	..	..	1	5	4	1	..	..
Total .	49	2		7	2	49	41	4	3	1

*This case was sent to hospital owing to delayed dilatation. Death occurred ten days after operation as the result of sepsis.
It is expected that the midwifery service will be extended during the current year.

GENERAL TABLE "D".

Monthly Record of Children under Observation at the Centre.

Age.		Number.	Full Term.	Infants premature.	Mother dead.	Reason for observation.					No co-operation from parents.	*Time observed in days. (1 day = 9 hrs.)
						Feeding difficulty.	Failure to gain weight.	Anæmia.	Alimentary disturbance.	Catarrhal Jaundice.		
Infants	Under 1 month	1	..	1	..	1	..	..	..	..	1	5
	1—3 months	2	..	1	1	2	..	..	..	..	..	92
	3—6 months	*Nil.*	..	..	..	..	..	..	..	..	..	..
	6—12 months	7	7	..	..	1	2	1	3	..	..	105
Toddlers	1—2 years	3	..	..	..	..	3	..	..	..	2	15
	2—3 years	*Nil.*	..	..	..	..	..	..	..	..	..	..
	3—4 years	1	..	..	..	..	..	..	..	1	..	1
	Total	14	7	2	1	4	5	1	3	1	3	218

* Children are kept from 8 A.M. to 5 or 6 P.M.

Much more could be done for premature and immature infants if a trained nurse were in charge of the observation ward, as the Health Visitors have ample work in the area. A twenty-four-hour service is essential, if premature and immature infants are to be cared for. It is a great strain on many mothers to bring and fetch their infants twice a day, besides offering exposure to weakly children. For these reasons many infants are not taken under observation, although requiring care. Where continuous care is necessary, the ward is open on Sunday also. The observation ward is an important item in the teaching programme and deserves improved facilities.

GENERAL TABLE "E".

Monthly Record of Nursery School Children.

Age groups by attendance in months.						Taking 22 as perfect attendance average attendance per child per month.	Causes of sickness among the children.														Age groups affected.
	2-yr.	3-yr.	4-yr.	5-yr.	6-yr.		Alimentary.	Respiratory.	Failure to gain weight.	Asthma.	Anæmia.	Otitis.	Measles.	Whooping cough.	Typhoid.	Scabies.	Fever.	Worms.	Sorethroat.	Ringworm.	Sores.	
January	..	6	13	4	..	17	..	2	..	..	..	..	..	..	..	2	..	..	..	..	..	3-yr.
	..	..	..	..	..	..	..	..	2	..	..	..	..	..	1	..	..	1	2	..	..	4 „
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	5 „
February	..	..	..	..	..	..	1	2	1	..	..	..	..	..	..	..	..	..	..	..	..	3-yr.
	1	8	9	5	..	14	..	1	1	..	..	1	..	..	..	..	..	..	..	..	..	4 „
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5 „
March	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	1	..	..	..	3-yr.
	1	6	9	7	..	18	..	1	2	..	..	..	..	..	..	..	1	..	..	..	..	4 „
	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	5 „
April	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	3-yr.
	..	5	10	7	1	13	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	4 „
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5 „
May	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3-yr.
	..	2	10	6	..	7	..	..	1	..	..	..	..	..	..	..	..	..	..	..	1	4 „
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5 „
June	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3-yr.
	..	2	9	7	..	10	..	2	1	..	..	..	..	..	..	..	..	..	..	..	..	4 „
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	5 „
July	..	..	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	3-yr.
	1	3	9	4	..	20	2	2	1	..	1	1	..	..	..	..	..	..	..	..	..	4 „
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5 „
August	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	3-yr.
	1	5	8	3	..	21	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	4 „
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5 „
September	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3-yr.
	..	8	7	4	..	17	..	..	..	..	1	..	2	..	..	..	..	..	..	..	..	4 „
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	5 „
October	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	2	..	..	..	..	..	3-yr.
	..	8	7	5	..	16	1	..	1	..	..	..	..	1	..	..	..	..	..	..	..	4 „
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5 „
November	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	3-yr.
	..	8	7	5	..	7	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	4 „
	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	5 „
December	School closed.					..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3-yr.
						..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4 „
						..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5 „
Monthly average of each age group.	0·4	6·1	9·8	5·7	..	..	3	9	1	..	..	..	3	..	..	2	3	1	..	..	..	3-yr.
	..	..	..	..	..	..	4	7	10	..	2	2	3	1	1	..	1	1	2	..	1	4 „
	..	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	1	..	..	1	1	5 „
							7	16	12	1	2	2	6	1	1	2	5	2	2	1	2	Total all groups.

Note on Nursery School : Table I.

In proportion to the number of children attending in the different age groups, the sickness rate appears to have been equal in the 3-year and 4-year groups: the 5 years group was definitely more healthy. "Failure to gain weight" showed a marked preponderance in the 4-year group.

Immunisation.

All children were given anti-typhoid inoculation in January 1939, and whooping cough vaccine, prophylactic dosage in August. This was the first time immunisation against whooping cough had been attempted. The infectious diseases prevalence was not higher in the school than in similar age groups attending the clinic.

The care of the preschool group is that least catered for at the centre, in fact apart from home visiting of toddlers and physical examination on attendance at the clinics, little can be offered, with the present accommodation and without an increase in the technical staff, it is impossible to plan improved care for this group.

The nursery school could not be really effective, staffed with one unqualified teacher who was responsible for the direction of the activities of such a wide age range. As can be seen from the table under special circumstances children under 2 years were admitted and occasionally a child over 5 years may be kept until the ordinary school term begins.

GENERAL TABLE "F".

Monthly Record of Occurrence of Infectious Diseases among Prenatal Cases (PN) Infants (I) and Toddlers (T) put on card during 1939, and the time when first seen.

Month.	Group.	Cholera.	Measles.	Smallpox.	Whooping cough.	Meningitis.	Tetanus.	Tuberculosis.	Syphilis.	Neisserian infection.	Scabies.	Typhoid fever.	Month.	Typhoid fever.	Scabies.	Neisserian infection.	Syphilis.	Tuberculosis.	Tetanus.	Meningitis.	Whooping cough.	Smallpox.	Measles.	Cholera.
January	PN	..	..	..	..	..	..	..	1	..	..	..	July	..	..	1	..	1	..	..	..	..	..	..
	I	..	2	1	1	1	..	..	1	..	..	..		..	1	..	..	..	..	..	..	..	..	..
	T	..	..	..	..	..	..	..	..	1	2	..		..	..	..	..	..	..	..	..	..	2	..
February	PN	..	..	1	..	..	..	2	..	..	..	..	August	..	..	1	1	..	..	..	..	..	..	..
	I	..	2	..	1	..	1	..	1	..	..	..		..	2	..	..	..	1	..	..	..	2	..
	T	..	..	..	1	..	..	..	..	..	1	..		1	..	..	1	..	..	..	..	..	..	..
March	PN	1	..	..	..	..	..	1	..	..	..	..	September	..	..	1	..	..	..	..	..	..	..	..
	I	..	..	..	..	..	1	..	..	..	1	..		..	..	..	..	..	..	..	3	..	..	..
	T	..	..	..	..	..	..	..	..	..	..	..		..	1	..	..	..	..	..	..	..	1	..
April	PN	1	..	..	..	..	..	..	1	..	1	..	October	..	..	..	..	..	..	..	..	..	..	..
	I	..	2	..	1	..	..	..	2	..	..	..		..	..	..	..	..	..	..	..	..	..	..
	T	1	1	..	..	..	..	..	..	..	..	..		..	2	..	..	..	..	..	..	..	1	..
May	PN	..	..	..	..	..	..	..	1	..	..	..	November	..	..	..	1	1	..	..	..	..	..	..
	I	..	2	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	1	..	..	..
	T	..	..	..	..	..	..	..	..	..	..	..		..	1	..	..	..	..	..	..	..	..	..
June	PN	..	..	..	..	..	..	..	..	2	..	..	December	..	2	..	1	..	..	..	..	..	..	..
	I	..	..	..	1	..	..	..	1	..	..	..		..	..	..	..	..	..	..	..	..	1	..
	T	..	1	..	1	..	..	..	..	..	..	1		..	2	..	..	..	..	..	..	..	..	..
Total	PN	2	..	1	..	..	..	5	5	6	3	..		..	..	..	..	..	..	..	..	..	..	..
	I	..	11	1	8	1	3	..	8	..	5	..		..	..	..	..	..	..	..	..	..	..	..
	T	1	6	..	2	..	..	..	1	..	9	2		..	..	..	..	..	..	..	..	..	..	..

The immunisation of infants against smallpox and whooping cough requires to be greatly extended.
Only 5 toddlers and 33 infants were vaccinated against smallpox, and 8 toddlers were revaccinated.

Index of Special Tables.—Referring to individuals put on card during 1939.

Prenatal.—No. I showing the percentage of cases who attended the clinic under the month when put on card, the total clinic visits paid, the month of pregnancy at the time of the first clinic visit, the number of out district and non-pregnant cases, those undelivered by the 31st December, those who left the district before delivery, and the result of the pregnancy if known.

No. II showing the health maintained during pregnancy, the complaints or diseases suffered from, and the number, and percentage to the total cases delivered during 1939, of those well throughout pregnancy.

No. III showing the number of the pregnancy in each case and the percentage of each parity to the total number of cases.

Lactating Mothers.—No. I monthly record showing the number who attended the clinic, the number of clinic visits paid, and of home visits received, the number "well" after delivery, and those unwell, stating the nature of the complaint.

Infants.—No. I showing the number who attended the clinic, the number of clinic visits paid, and the number paid by well children only, the number of home visits received, the number of premature births, the agencies of delivery, and the defects, and causes of sickness, other than the infectious fevers, among the infants.

Infants.—Table II showing the age when taken on card and the percentage of each age group, the mortality incidence, the causes of death and the number in each age group under six months which received feeds other than of breast milk.

Toddlers.—Table I showing the age groups as recorded at the time when put on card, the number attending the clinic, the number of clinic visits paid by well children, the number of home visits received, the number who left the district during the year the number not weaned at eighteen months, the sickness incidence and causes other than infectious fevers.

PRENATAL TABLE No. I.

Prenatal cases put on card during 1929.

Month when put on card.	Total.	Attended the clinic.	Per cent. of total.	Number absent from	Non-pregnant.	Total No. of clinic visits paid.	Month of pregnancy at the time of paying the first clinic visit.									Left the area before delivery.	Undelivered by 31st December 1929.	Result of pregnancy.				Now-births.	Unknown.
							1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	8th.	9th.	10th.			Full term.		Premature.			
																			Alive.	Still born.	Alive.	Still born.		
January	37	20	74	Nil.	3	82	..	..	3	3	1	3	1	3	..	2	1	..	15	..	..	..	3	6
February	37	19	82·9	1	1	85	..	..	3	3	1	3	1	3	..	2	1	..	14	..	2	1	2	17
March	38	27	71	2	2	120	1	2	6	1	3	..	..	2	2	1	2	..	14	..	3	..	3	18
April	32	19	59·3	Nil.	2	92	..	..	1	6	6	1	4	4	3	..	2	..	10	..	..	..	1	9
May	34	19	73	Nil.	2	86	..	..	1	2	3	2	4	1	4	..	2	..	11	..	1	..	..	10
June	34	27	79·4	Nil.	2	96	..	..	2	3	3	2	1	3	2	1	2	..	6	..	1	..	2	14
July	31	18	80·7	1	3	66	..	2	2	2	3	..	..	2	4	..	1	..	6	1	1	..	2	8
August	19	14	77·7	1	1	61	..	1	1	2	4	2	2	3	..	1	2	..	10	1	..	..	..	6
September	28	22	82·6	2	2	69	..	1	2	1	1	1	4	3	1	1	2	4	4	..	1	..	1	4
October	10	8	80·0	Nil.	2	63	..	1	3	1	2	3	3	2	1	..	1	13	8	..	1	..	..	2
November	23	17	69	2	2	53	..	1	2	2	1	..	..	2	..	..	1	8	1	..	..	..	..	..
December	17	8	47	1	Nil.	17	1	2	1	1	1	2	1	1	..	..	..	11	..	..	..	..	..	..
																		17						
Total for the year	341	218	Average 73·18 per cent.	10	15	810	2	10	29	26	33	23	24	26	21	6	34=13·6 per cent. of total delivered by 31st December.	62	101*	1	9	1	10	58=40 per cent. of deliveries, in the area of cases on card.

* Including 2 abnormal deliveries.

TABLE No. II.

Prenatal cases put on card in 1939 who attended the clinic.

Showing the health maintained during pregnancy and the complaints or diseases suffered from.

Total number attended the clinic according to month put on card.		Well throughout pregnancy.	Osteomalacia.	Abdominal pain.	Anæmia.	Anæmia with oedema.	Anæmia with sore tongue.	Fever, Malaria.	Excessive vomiting.	Anti-partum bleeding.	Albumin in urine.	Pre-eclamptic signs.	Asthma.	Infectious Diseases: Small pox.	Cholera.	Tuberculosis.
January	17	8	..	..	1	1	1	..	..	..	4	1	..	..	..	..
February	18	4	..	..	2	3	..	..	2	..	2	1	..	1	..	2
March	25	3	..	..	8	4	..	..	..	1	5	1	..	..	1	..
April	17	8	..	..	3	..	..	..	..	..	1	2	..	..	1	..
May	18	13	..	..	1	..	1	..	..	..	..	2	..	..	..	..
June	24	17	..	1	..	..	..	3	..	..	..	1	..	..	..	..
July	17	8	1	..	2	1	1	..	..	..	1	2	..	..	..	1
August	13	6	1	..	3	..	1	..	..	..	1	..	..	..	..	..
September	23	11	..	..	6	1	1	..	..	..	2	..	1	..	..	..
October	8	6	..	..	1	..	..	..	..	..	..	..	..	..	..	..
November	15	9	..	..	3	..	..	..	..	..	1	..	..	..	..	1
December	8	1	..	..	2	1	..	..	2	..	..	..	..	..	..	..
	201	94* =67·6 %	2	1	37	11	5	3	4	1	17	10	1	1	2	4

*% of total pregnancies terminating before 31st December 1939.

TABLE No. III.

Prenatal cases put on card in 1939 who attended the clinic.

Arranged to show the number of the pregnancy and the percentage of each parity to the total. Pregnancies over the sixth are grouped together.

Total number attended the clinic according to month put on card.	Infectious Diseases.				Para.							Total.
	Syphilis.	Gonorrhœa.	Scabies.	Resp.	1st.	2nd.	3rd.	4th.	5th.	6th.	6th*.	
January 17	1	..	..	..	4	3	2	2	2	2	2	=17
February 18	..	1	..	..	1	1	..	5	4	1	6	=18
March 25	..	..	..	2	4	5	1	6	2	1	6	=25
April 17	1	..	1	..	3	4	2	1	2	2	3	=17
May 18	1	..	..	..	2	1	5	5	2	2	1	=18
June 24	..	2	..	..	4	5	5	6	1	..	3	=24
July 17	..	..	..	..	..	4	3	5	1	1	3	=17
August 13	1	1	..	..	2	3	4	1	1	1	1	=13
September 23	..	1	..	..	2	4	7	3	2	3	2	=23
October 8	..	1	..	..	1	..	2	1	2	1	1	= 8
November 15	1	..	..	..	2	2	5	2	1	1	2	=15
December 8	..	..	2	..	1	..	3	..	1	..	3	= 8
	5	6	3	2	Total 26% of total	32	39	37	21	13	33	=201

12.9,15.9,19.4,18.4,10.4, 6.4,16.4 (Approximate).

TABLE I.

Lactating Mothers put on card during 1939.

	Total.	Attended clinic.	Clinic visits paid.	*Home visits paid.	Well.	Symptoms of anæmia.	Vitamin C. defy.	Malaria.	Tuberculosis.	Breast abscess.	Syphilis.	Gonorrhœa.	Albumuria.	Scabies.	Non-infective Leucorrhœa.	Pelvic pain.	Again pregnant.
January	18	18	37	35	11	6	..	1	..	..	..	..	..	..	..	..	..
February	9	8	12	14	4	5	..	..	..	..	..	..	..	..	..	..	1
March	7	7	32	26	1	1	3	1	..	..	..	..	..	..	..	..	1
April	10	10	58	30	5	3	..	..	..	1	1	..	..	..	..	..	..
May	5	5	9	11	2	..	..	..	..	..	..	1	..	..	1	1	..
June	5	5	18	5	3	1	..	..	..	..	..	..	..	..	..	..	..
July	4	4	6	4	2	2	..	..	..	..	..	..	..	..	..	..	..
August	6	6	12	8	1	3	..	..	..	..	..	..	..	1	..	..	..
September	9	8	35	12	4	1	..	1	1	..	1	..	1	..	..	..	..
October	11	11	16	6	7	4	..	..	..	..	..	..	..	..	..	..	..
November	9	9	17	2	4	2	..	..	..	..	..	..	1	..	..	..	..
December	3	3	35	12	4	1	..	1	1	..	1	..	1	..	..	..	..

* Not including post natal visits during first ten days of the puerperium.

50 per cent. of the women were well after delivery, 30 per cent. exhibited the signs and symptoms of anæmia—films were made in all cases, and a complete examination of the blood when severe anæmia was present: on the whole the degree of anæmia was not great. Over 97 per cent. of this group attended the clinic.

INFANTS : TABLE 1.

Infants put on card during 1939.

Month when put on card.	Total.	Attended clinic.	No. of clinic visits paid.	Clinic visits paid by well children.	Home visits paid.	Left district.	Out district.	Premature infants.	Vaccination done at clinic.	Congenital defects.			Complaints and diseases other than infectious fevers.													Agencies of delivery.					
										Hernia.	Heart.	Absence of anus.	Alimentary.	Respiratory.	Otitis.	Boils.	Septic cord.	Conjunctivitis.	Defective development.	Rickets.	Convulsions.	Tetanus.	Scabies.	Thrush.	Failure to gain weight.	Trained service.	Hospital.	Dal.	Relative.	No one.	Other.	Unknown.
January	53	30	115	53	211	4	1	..	3	2	1	..	5	1	..	..	..	..	1	..	..	..	..	1	3	7	11	23	1	2	..	2
February	53	17	61	24	143	4	..	..	9	3	..	..	2	8	2	..	..	..	..	..	..	1	..	..	..	10	9	21	..	2	..	..
March	48	20	90	47	203	..	..	1	12	..	..	..	2	4	4	..	1	..	1	..	..	..	1	..	..	11	8	24	..	3	..	..
April	29	13	125	97	192	4	1	1	4	1	..	..	2	..	..	4	..	..	..	..	..	..	..	..	..	10	4	13	..	1	..	..
May	16	14	51	40	165	5	..	1	..	..	..	..	..	1	1	1	..	..	1	..	..	..	..	..	..	12	5	7	1	..	1	..
June	30	18	69	22	117	2	..	..	4	1	..	..	1	6	..	1	..	..	..	1	..	..	..	1	..	7	6	18	1	1	..	1
July	22	10	31	14	38	4	2	..	..	1	..	..	..	2	..	..	..	..	..	1	..	..	1	..	1	4	4	12	..	..	..	2
August	29	12	93	61	117	2	..	..	..	..	..	..	1	4	..	..	..	..	..	..	..	1	2	..	1	9	7	13	..	..	..	..
September	31	2	63	39	94	2	1	..	..	..	..	..	..	7	..	..	..	..	..	..	2	..	..	1	..	5	11	15	..	..	..	..
October	36	17	60	24	147	2	2	..	..	1	..	..	2	1	..	..	..	..	..	..	..	..	..	2	..	12	7	16	..	..	..	..
November	31	11	33	16	74	1	6	..	..	1	..	1	..	1	..	..	..	1	..	..	..	..	..	..	..	9	5	15	..	..	..	1
December	32	5	7	3	61	..	3	1	11	..	..	..	..	2	..	..	1	1	..	..	..	..	..	3	..	5	6	19	..	..	..	..
Total	371	169	798	440	1,562	30	16	4	33	10	1	1	15	37	7	6	2	2	3	2	2	2	4	8	5	101	83	196	3	9	1	6

INFANTS : TABLE 1.

The percentage 45·5 of infants put on card during the year, who attended the clinic is low compared with the ante-natal percentage 73·18. Infant care is at present not very effective, although the fact that 55 per cent. of the clinic visits paid by this group of infants was paid by well children, is encouraging as an indication of health consciousness among the mothers. Respiratory diseases played a prominent part in the sickness rate, being responsible for 39 per cent. of all sickness and for 2 deaths (during the first and third quarters of the year respectively). Alimentary, conditions formed 13·7 per cent. of all sickness, but caused 8 deaths or 44·5 per cent. of the total deaths. The distribution of these deaths was more general, occurring in all quarters of the year. Conditions due to lowered vitality such as otitis and boils, and those due to indifferent hygiene, such as thrush and scabies, were together responsible for 67·5 per cent. of the total sickness. Rickets appeared less conspicuously than in the toddler group. Defective feeding was responsible largely for the five cases of " failure to gain weight ". It will be noted that no attempt has been made to correlate the births registered with population figures or to offer rates. In the absence of a fact guiding survey of the area all such attempts are necessarily futile : the population movement in this area is probably relatively high, as can be seen to some extent from the figures in the Ante-natal, Infant and Toddler Tables in the column " Left the district ". The population is largely non-indigenous and therefore susceptible of movement ; this makes the tracing of records very difficult. *Agencies of delivery* :—Those four hundred deliveries include twenty-nine of ante-natal cases put on card during 1938. It will be seen that deliveries by dais equal the total deliveries conducted by trained service, at home and in hospital. " Trained service " includes delivery by a doctor at home ;—this occurred in 3 cases.

INFANTS: TABLE II.

Infants taken on card during 1939.

* Showing the numbers of infants put on card monthly at various ages, the proportion receiving feeds other than of breast milk, the deaths which took place among infants during the year and the causes of death.

Month during which put on card.	Under 1 month of life.	2-3 months.	3-6 months.	6-9 months.	9 months to 1 year.	Total.	Receiving feeds of milk other than breast milk from 1st month.	2nd month.	3rd month.	4th month.	5th month.	6th month.	Total.
							%						
January	18	30	4	1	0	53	4=22·2	2	5	3	0	0	=14
February	20	29	5	1	0	54	6=30·0	4	1	1	0	3	=15
March	*34	8	2	0	4	48	8=23·5	2	2	2	0	1	=15
April	*19	7	2	1	0	29	3=15·7	3	2	3	0	1	=12
May	*17	5	2	1	1	26	0=0	0	0	1	0	2	=3
June	19	5	5	0	1	30	2=10·5	2	4	2	..	..	=10
July	14	3	0	5	0	22	3=2·1	0	1	0	0	1	=5
August	23	5	1	0	0	29	2=8·7	2	1	1	..	1	=7
September	20	6	3	1	1	31	4=20·0	1	1	1	1	2	=10
October	30	3	0	2	1	36	6=20·0	2	0	1	0	0	=9
November	*21	7	1	2	0	31	2=9·5	1	2	0	0	0	=5
December	24	5	3	0	0	32	3=12·5	1	1	0	2	0	=7
Total	259	112	28	14	8	421	43	20	20	15	3	11	112
% of Total 100% =421	61·5	26·7	6·6	3·3	1·9	% of Total 100% 112 38·4		17·85	17·85	13·4	2·68	9·82	

* Indicates 1 premature infant in the group against which it is placed. None of the deaths were of premature children. With the transference of the postnatal care of the infant to the Health Visitors, it is hoped that better control of feeding during the first month will be established: it will be interesting to note whether the proportion of children put on artificial feeding will fall. In some cases after cow's or other milk had been adopted, the mother was persuaded to return to breast feeding. It is hoped during the current year to increase the proportion of infants put on card before the end of the first month, the present percentage, 61·5, is undoubtedly rather low.

INFANTS: TABLE II—*contd.*

Infants taken on card during 1939.

Month during which put on card.	Causes of death.									
	Deaths.	Enteritis.	Malnutrition.	Tetanus.	Pneumonia.	Smallpox.	Erysipelas.	Meningitis.	Congenital Heart.	Accident.
January	3	1	..	..	..	..	..	1	1	..
February	1	..	..	..	1	..	..	..	..	..
March	5	1	1	1	..	1	1	..	..	..
April	4	1	1	1	..	..	..	..	..	1
May	0	0	..	..	..	..	..	..	..	..
June	0	0	..	..	..	..	..	..	..	..
July	0	0	..	..	..	..	..	..	..	..
August	2	1	..	1	..	..	..	..	..	..
September	1	..	..	..	1	..	..	..	..	..
October	2	2	..	..	..	..	..	..	..	..
November	0	..	..	..	..	..	..	..	..	..
December	0	0	..	..	..	..	..	..	..	..
Total	18	6	2	3	2	1	1	1	1	1
	% of Total deaths 33·3		11·1	16·6	11·1	5·6	5·6	5·6	5·6	5·6

TODDLERS : TABLE I.

Put on card during 1939.

Month when put on card.	Under 2 years.	Under 3 years.	Attended clinic.	No. clinic visits paid.	C. Visits by well children.	No. of home visits paid.	Not weaned at 18 months.	Left District.	Out District.	Complaints other than Infectious Diseases.											
										Alimentary.	Respiratory.	Marasmus.	Malnutrition.	Rickets.	Thrush.	Otitis.	Boils.	Anaemia.	Failure to gain weight.	Accident.	Eczema.	Fever.
January	20	2	14	80	35	62	2	3	1	1	1	..	1	1	1	..	..	..	2	1	..	..
February	15	1	6	15	9	34	2	1	..	..	1	..	..	1	..	..	..	..	..	..	1	1
March	8	1	7	66	31	40	2	3	..	..	2	1	..	1	..	..	..	..	..	..	..	..
April	5	2	6	25	17	29	4	3	..	..	..	..	..	1	..	..	1	..	..	..	..	..
May	2	..	1	2	1	6	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..
June	7	1	8	37	22	26	3	2	..	..	..	..	..	..	..	1	..	..	..	..	..	..
July	5	..	5	38	28	16	2	1	1	2	2	..	1	..	..	..	..	..	..	..	..	..
August	8	1	8	56	29	21	1	..	..	..	..	..	1	..	..	1	..	..	1	..	..	..
September	5	4	4	28	8	7	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..
October	7	1	7	21	12	12	..	..	..	1	1	..	..	..	..	..	..	..	1	1	..	..
November	4	..	3	7	3	4	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..
December	10	..	9	17	10	5	2	..	..	2	1	..	..	..	..	..	..	1	..	..	..	..
TOTAL	96	13	68	387	205	262	18	13	2	6	9	1	3	5	1	2	1	3	4	1	1	1

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